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T H I R T Y - F I R S T A N N U A L R E P O R T

FOR THE CALENDAR YEAR 1941

Northern
Rocky Mountain
Forest and Range
Experiment Station
Missoula, Montana
M. Bradner, Director

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January 1948

Montana and Idaho. In addition to the state agricultural experiment stations, the Soil Conservation Service, Farm Security Administration, and the Bureau of Plant Industry of the United States Department of Agriculture are also carrying on research work in the field of agriculture.

INTRODUCTION

The Northern Rocky Mountain region can logically be divided into two distinct subregions. The portion of Montana lying east of the Continental Divide is a semiarid, rolling grass land with occasional isolated mountain masses. For the most part, forests are restricted to the moister areas at the higher elevations. This portion of the region depends chiefly upon range husbandry and upon dry farm and irrigated agriculture and upon recreation. The area composed of northeastern Washington, northern Idaho, and that portion of Montana west of the Continental Divide is primarily a forested area; 77 percent of the gross land area is classified as forest land. In this portion of the region agriculture, mining, lumbering and forestry, and recreation are important industries.

The economic life of the Northern Rocky Mountain region as a whole is, therefore, based chiefly upon agriculture, forestry, mining, and recreation. Within each of these fields, one or more agencies is responsible for conducting the research necessary for the development of effective practices. In the field of agriculture well established state experiment stations are found at Pullman, Washington, Moscow, Idaho, and Bozeman, Montana. The personnel of these stations work quite largely on the problems of farm management. Range livestock management studies are being made at the forest schools in Missoula, Montana, Moscow, Idaho, and Pullman, Washington. Work in the general field of water conservation is being carried on in

Montana and Idaho. In addition to the state agricultural experiment stations, the Soil Conservation Service, Farm Security Administration, and the Bureau of Plant Industry of the United States Department of Agriculture are also carrying on research work in the field of agriculture.

Forest research work is chiefly, though not exclusively, centered in the Northern Rocky Mountain Forest and Range Experiment Station. Work of this nature is being done by the Division of Plant Disease Control of the Bureau of Entomology and Plant Quarantine, and the entomological laboratory of the Bureau of Entomology and Plant Quarantine at Coeur d'Alene, Idaho. The forest schools of the region at Pullman, Washington, Moscow, Idaho, and Missoula, Montana, are also carrying on forest research work.

Mining research for the region centers at the Montana School of Mines in Butte, Montana, and the School of Mines, Moscow, Idaho.

In this region, and in Montana especially, recreation is an important industry. Research that has a bearing on this industry is being carried on by the Park Service of the United States Department of Interior, by the state highway commissions, and by the fish and game commissions of the several states, in cooperation with the Federal Government under the Pittman-Robertson Act. At this station through the cooperation of the Fish and Wildlife Service of the Department of Interior a research project in forest and wild life relationships has recently been undertaken. Eventually this project may undertake work in the field of wild life management that will

have a direct bearing on the recreation industry. To the extent that living, healthy, green forests attract recreationists to the region, the research work being done by this station on forest fire

protection projects and on timber cutting practices has a direct bearing on the recreation industry.

With this much of a picture of the basic economy of this region and the research organizations that are active in it, we can proceed to a consideration of the specific field of research of this station. Our effort lies chiefly in the field of forestry, agriculture (range phases), and recreation. In the field of forest and range research, the station's primary aim is to discover ways and means of growing and harvesting successive forest and range crops - including wood products, forage, and wild life - and of perpetuating the intangible beneficial effects of vegetative cover on stream flow and recreation. Each of the station divisions contribute to one or more of these ends. A portion of the remainder of this report is given to a discussion of methods to establish forests artificially. 4. Studies of stand improvement from the time of stand establishment to maturity for the purpose of improving the quality and quantity of the forest crop, regional need for research in the field of the given division, (2) a statement of past work accomplished in meeting this need, including progress made during 1941, and (3) a statement of the priority of future work contemplated by the divisions. Following the individual division discussions, a two-point program is suggested for increasing the effectiveness of the station approach to the outstanding forest modification of silvicultural practice to include the impact upon the forest of disease, insects, and physical agencies. These items

supply the gross dimensions of the picture through which silvicultural

SILVICULTURE

knowledge and research needs and efforts of the region are spread, on

Field of Research

In silvicultural research we have the responsibility for determining and improving upon methods of growing and harvesting forest crops in the northern Rocky Mountain region. A picture of this responsibility is given in the gross dimensions of five major commercial forest types and six rather arbitrarily divided fields of research effort. The picture's breadth consists of forest types as follows: 1. western white pine, 2. ponderosa pine, 3. western larch-Douglas-fir, 4. lodgepole pine, 5. Engelmann spruce. The height dimension is made up of: 1. Basic silvical studies to determine growth habits, characteristics, and requirements for each important species of each type. 2. Studies of harvest cutting methods - the "how" of cutting each type to obtain the maximum crop within economic limits and yet provide for a new crop of desired species. 3. Studies of methods to establish forests artificially. 4. Studies of stand improvement from the time of stand establishment to maturity for the purpose of improving the quality and quantity of the forest crop. 5. Studies of tree and stand volume, growth, and yield - the measurement or mensurational field of forest management. 6. Application studies: (a) to determine which silvicultural techniques are practicable in the light of anticipated returns as a result of treatment; (b) to correlate silvicultural practice with forest protection, i.e., the modification of silvicultural practice to include the impact upon the forest of disease, insects, and physical agencies. These items

supply the gross dimensions of the picture through which silvicultural knowledge and research needs and effort of the region are spread, without giving emphasis to the highlights and shadows or to the completeness of the picture. type. The remainder of knowledge making

Status of Work

So far as silvicultural knowledge is concerned, the highlights are mainly toward the white pine side of the picture with streaks of light here and there among other types. This is to be expected as research effort has largely been concentrated in the white pine type because of its commercial importance. The result of this research and also of practical experience gives an unusually well-rounded silvicultural picture for this type, probably as complete and well-rounded as for any major forest type in the country. The publication during the last year of U.S.D.A. Bulletin 757, "Natural Regeneration in the Western White Pine Type," marked an end to a long series of studies on the silvies and silviculture of the type. This comprehensive bulletin gives a detailed description of the silvies of the type and discusses in detail the applicability of the various silvicultural systems to the white pine type. It and companion publications already issued on appropriate stand improvement measures, on growth and yield, on the economic management of the type (a bulletin now in process of publication), and on various other phases, provide an excellent factual basis for managing white pine forests for maximum benefits. Of course, there are still gaps which future studies must close. The type. These studies are mainly of the following:

(a) Silvicultural knowledge of other forest types of the region is very incomplete. The station has contributed most in information on growth and yield. It has also contributed materially to the management of the ponderosa pine type. The remainder of knowledge making up the present basis for management of these types has come from experience through actual management, administrative studies, and from information on the types gained in other regions.

But present knowledge is not necessarily a complement of present research needs; these are determined more by the commercial importance and present degree of utilization of the forest type. A good many gaps may be found in the picture which do not need filling at the present time. Other spots need attention badly. The more pressing needs for research at the present time include:

1. Studies of harvest cuttings to determine (a) Practicability of partial cuttings in the white pine type, as a stop-gap cutting in mature stands to reduce mortality and as an increment cutting in immature stands. (b) Practicable cutting methods for the Engelmann spruce type. (c) Improved cutting methods for the larch-fir and ponderosa pine types.

2. Studies of stand improvement in the white pine and ponderosa pine types to round out present knowledge as a basis for a possible increase in this work as a part of any post-war employment program.

3. Application studies to fit knowledge gained through silvicultural research into forest management, especially in the western white pine type. These studies are mainly of two patterns:

(a) Economic application studies - the tempering of silvicultural techniques with practical economics. (b) Correlation studies to modify silvicultural practices so they will dovetail with measures necessary for forest protection.

These are the outstanding needs. Many other studies, such as planting investigations, studies in the management of culled-over stands of the white pine type, certain mensurational studies, and certain silvical studies of species requirements, especially soils work, are needed now for improvement in management practices, but these are not as pressing as those listed.

It is ludicrous to speak of a silvicultural research division or a well-rounded silvicultural research program when the personnel engaged in such research consist of one full-time staff member assisted by a superintendent of an experimental forest and a few months' time by field assistants. Obviously, it is impossible to meet our responsibilities in the field of silvicultural research; all we can hope to do is tackle the more pressing demands for information. Recognizing this limitation, it is believed the station is making, and can make, real progress.

During the last year much of the effort was given to studies of partial cutting in the western white pine type to determine their practicability in harvesting potential mortality by removing defective and poor vigor trees in mature stands. If the promising indications of success for the method are realized, it will mean that in certain of our mature stands potential losses may in a large measure be

utilized and the stands converted from a nongrowing to a growing basis. There is also the very real possibility for obtaining insect control in certain stands through such cuttings. Before loss of funds caused discontinuance of full-time support for our direct-seeding project, continued observance of existing plots gave encouraging results. It is reasonably safe to say that we can now direct-seed western white pine, ponderosa pine, and Douglas-fir with success on selected sites at from 55 to 75 percent of planting costs. The success is due largely to a rodent poisoning method developed by the Control Methods Laboratory of the Fish and Wildlife Service. We have tests to show, too, that western redcedar and Engelmann spruce may be seeded without protection from rodents. As these two species are very exacting in their site requirements, they probably can be seeded only in limited areas. Additional experiments are needed to reduce the cost of seeding, simplify its application, broaden its scope, and define its limitation. We are fortunate in obtaining help for this work by the assignment of a junior biologist to the station by the Fish and Wildlife Service. It is unfortunate that continued station participation must be at the expense of other work.

During the past year we have also met several calls for help from other agencies. We continued to cooperate with the blister rust control organization in developing guides to determine priorities of control work. Some assistance was given the University of Idaho and Forest Service Administration on their cooperative study of

mortality in young white pine stands. We gave some help, but not as much as needed, to farm forestry projects.

Maintenance of permanent sample plots and records has again eaten heavily into the time of the one permanent staff man. We have cut and streamlined this work as much as possible in an attempt to reduce it to the minimum, but it still requires considerable time.

Priority of Future Work

The war has not materially changed the direction our silvicultural studies should take during the coming year. It simply emphasizes our responsibility for determining methods to keep forest land at maximum productivity. Our contribution to war effort will be to prune non-essential work to the bone and concentrate on jobs which will contribute the most.

In brief, our plans for silvicultural work during the coming year include the following in approximate order of priority:

1. Maintain important permanent plots and records.
2. Continue studies of partial cutting in white pine stands, including cutting tests on the Deception Creek Forest and operation of this field station.
3. Prepare manuscript on early development in stands of the white pine type.
4. Begin preliminary studies to determine methods of cutting Engelmann spruce.
5. Continue cooperation with the blister rust control organization in improving upon guides for determining control priority for specific areas.
6. Continue direct seeding studies on a cooperative basis with the Fish and Wildlife Service and the Forest Service Administrative Office of Planting.

FIRE RESEARCH

Field of Research

Although the regional need for fire research results has not changed materially, even under the impact of war, the present status of several of our previous projects, together with certain recent limitations, call for a radical revision of the fire research program at this station in 1942.

In reviewing regional needs for research, it is essential to look far beyond the immediate future. If that had not been done in the twenties, we would not have had a method of measuring fire danger ready for use when it was urgently needed in the thirties. If five years of work in fire-control-planning research had not been done in the early thirties we would be seriously lacking in facilities now when man power is going to be stripped to the barest minimum and adequate facilities are of the utmost importance. Fire research, if it fulfills its possible functions, must do far more than attack urgent, current problems. It must foresee the problems of years and even decades hence, and on that basis begin work which will provide solutions when the time of real need arrives.

At present the most acute problems in forest fire control are not believed to lie in a lack of technical knowledge. The major difficulty today is a lack of flexibility in the use of man and finances. As a result of this, much of the technical and practical knowledge already available cannot be put to use.

Listed in order of basic importance, the fire problems on which research might contribute are, briefly:

1. What is "adequate" fire control? Someone has said that "No goal has ever yet been reached until it was clearly defined," yet "adequate protection from fire" has never been specifically defined in economic terms. Definitions intended for Forest Service use have not been accepted by any other agency - Federal, State, or private. This is clearly problem number 1.
2. What is the lowest cost at which adequate control can be provided?
3. What permanent facilities such as lookout stations, roads, and telephone lines are essential to guarantee adequate control over a period of years, including easy, average, and critical seasons?
4. What man power is needed to meet (a) easy, (b) average, and (c) critical days and seasons?
5. For most efficient suppression of fires, how many men and what equipment should be sent to each fire in (a) a fuel type in which fire will spread at the highest rate and in which construction of control line is most difficult; (b) a fuel type of average rate of spread and average resistance to control; (c) the slowest spreading and easiest control type on (1) an easy day, (2) an average day, (3) a critical fire day?

6. Although the prevention of man-caused fires is a major problem in many regions, it is minor here because (a) three-fourths of our fires are caused by lightning, (b) the fire control force sufficient

to handle the unpreventable lightning danger will be adequate to handle the few unpreventable man-caused fires which will occur despite all prevention efforts.

Status of Work

During the past 20 years our fire research has included, at one time or another, projects devoted to all of these problems except 1 and 2. Our past research in "fire behavior" has contributed a method of measuring and rating fire danger, essential to the solution of problems 4 and 5. Hornby's work in fire control planning is nationally known as a marked contribution to the solution of problem 3. 76 fires studied in 1939 and 1940. Likewise, the useful information

During the past year circular 591, "Influence of Altitude and Aspect on Daily Variations in Factors of Forest-Fire Danger," was published to show differences in fire danger on a typical August day from valley bottom to ridge top, on north- and on south-facing slopes, at every hour of the day and night. A zone, called the "thermal belt," was found, within which fires can be ignited more easily and will spread faster for more hours per day than above or below this zone, other things such as fuel type being similar. This finding has a direct bearing on the location of fire control facilities (3) above, the placement of men (4) above, and the number of men to send to a fire (5) above.

Also published in 1941 was a mimeographed account of "How the Wind Blows in the Forest of Northern Idaho." This shows that less men need be sent to a fire under green timber and that the first task

of such men is not necessarily to prevent the fire from spreading on the surface. The first need is to keep that fire from getting off the ground and up into the tree tops where the wind velocity may be eight times as great as on the ground. These results have already been applied in the solution of problem 5.

Owing to the occurrence of an easy fire season in 1941 there were no fires suitable for studying rate of spread, yet accurate determination of rate of spread in our complex fuel types is essential to the solution of problems 2, 4, and 5 above. Six test fires were set, nevertheless, and the data obtained from these will be added to that for 74 fires studied in 1939 and 1940. Likewise, the usable information available on the fire reports for 1939 and 1940 was extracted and added to that for previous years as a very general and not too dependable index of rate of spread of fire in different fuel types on different classes of fire day - easy, average, and bad.

With two trained fire research assistants lost to the Army in 1941, with no funds to hire replacements, and with CCC assistance already greatly reduced and likely to be entirely lost during 1942, the three remaining members of the fire research staff - Hayes, Stickel, and Gisborne - will be forced to modify their field work materially in the immediate future.

Priority of Future Work

Additional field work to determine the distribution of fire danger, particularly down the north and south sides of a steep and narrow mountain valley, will be postponed in order to extract more

information from the five years of measurement which provided the information for circular 591, "Influence of Altitude and Aspect on Daily Variations in Factors of Forest-Fire Danger," previously mentioned. Completion of these reports is of high priority because this particular circular was intended to cover only the "median" or most common August day. It was also intended to concentrate particularly on the technical features of the study, and so to serve as a master reference source. The available data are much more comprehensive, however, and the technical reporting already done must be interpreted and condensed for most efficient use by field men. Hayes will give practically all of his time during the coming year to this further analysis and interpretation. The results will be immediately applicable to problems 3, 4, and 5 above.

For the past four years the Forest Service and all National Parks and Indian Agencies in this region have used our model 5 fire danger meter in their daily measurement of fire danger at some 225 stations. They have used these "danger ratings" as a guide to determine the number of men that they should have on duty, problem 4, in order to attempt to provide adequate protection at least possible cost. When the "rating" was high these agencies stationed more men throughout the forest, if their available funds permitted. When the rating was low they did not employ these men or they removed them from their fire control stations and used them on other work, if they had funds for such "other work." The result was maximum protection when the need was greatest but least cost when the need was least, a definite

drive toward the solution of problem 3. ~~benefits of fire control~~

The present danger meter is not perfect, however, and its improvement is of especially high priority in our program because of the widespread and everyday use of the device. Some of the difficulties, such as using only one size of stick to determine fuel moisture, and using calendar date instead of direct measurement of the inflammability of grasses, weeds, and shrubs, will require considerable research before they can be removed. Several others, however, have been studied during the past four years and can now be removed or at least improved. Osborne is already engaged on these improvements and new danger meters should be ready for use by June 1. No other work is planned in the near future in fire danger measurement research. ~~conditions on the ground, with concurrent acquisition of~~

By reducing further work in fire danger measurement, it will be possible for Osborne to commence a preliminary exploration of problem 1 - the determination of what is "adequate" fire control, which was given a high priority rating by the recent Priest River Fire Conference. In the opinion of some individuals, this is not only extremely basic but is urgently needed work. Not urgent in the meteorological sense that results must be obtained tomorrow or even next year, but urgent because the problem is so vital, and the solution or even progress is so likely to cast an entirely new light on both the processes and the finances of fire control. It seems entirely possible that a more specific determination of what constitutes "adequate fire control" when all the resources at stake are duly considered, may so

expand the concept of the task and the benefits of fire control that some of the existing impediments, financial and otherwise, may be more easily removed. Ira H. Gabrielson stresses this by his statement in "Wildlife Conservation": "Recognition of the increasing public benefits to be derived from the recreational uses of the forests will give added weight to the growing sentiment in favor of forest conservation." And he might have added "particularly forest protection and forest research."

Preliminary exploration of the economics of the fire problem is so intimately related to a satisfactory problem analysis that an attempt will be made to combine both jobs. This can best be done by a personal visit to Regions Two, Three, and Four and an inspection of fire conditions on the ground, with concurrent acquisition of local data essential to both the problem analysis and any future work in fire economics. A large part of Gisborne's summer field season is being planned for this high priority work.

One minor project of high priority in the Division of Forest Protection is the revision of our "Climatological Summary for the Priest River Station," one of the oldest forest and mountain meteorological stations in the entire West. The first summary, covering the 20-year period 1912-31, published in 1932, should now be expanded to include the full 30 years of record. This is being done by Stichel and should be completed by May 1942.

One major project which has been given high priority for the past 11 years is the study of the effect of forest canopy density on

the weather and the inflammability of fuels beneath. As has been pointed out, the 1941 fire season at last contributed "easy" conditions for one season. These were essential to round out the previous data comprising eight average seasons and two that were critical. Field work may now be discontinued on this project.

This study has been aimed at the solution of problems 3, 4, and 5 above and has long been recognized as truly basic in character. Two progress reports have been published and the final report covering differences and similarities during easy, average, and critical seasons should be of value in other regions as well as our own. Analysis of data and preparation of the report will be a time-consuming job, however, and it could be postponed if war demands it. On the other hand, due to the impossibility of an adequate field attack on the rate of spread study Stickel will be available to undertake this analysis and report writing as soon as the 30-year summary of climatological data is completed.

Except as indicated above, very little work has been done by this station since 1936 on problem 3, Fire Control Planning. Lack of such work has not been a failure or an oversight, however. Instead, Hornby's pioneering in planning for most efficient fire control facilities actually carried the theory so far ahead of practice that a 5-year respite was rather desirable. Now, however, most of Hornby's methods and principles have been applied on the ground and it is altogether desirable to examine the effects. This can be done by analyzing the fire records of the past 10 years, the first five

covering pre-Hornby practices, the last five showing the effects of his work. of widespread interest in, and actual use of, fire

While such a comparison of 1931-35 against the 1936-40 records cannot be perfectly satisfactory, because the first period contained two critical years while the last had none, still the records should furnish considerable evidence as to the sufficiency and perhaps the added cost of these improvements in permanent facilities. Such a study, when made, should have the benefit of the combined experience of one man thoroughly familiar with fire control practices and one familiar with research methods of analysis. It is possible that research compilation might be commenced during the coming year as the fire records are all available in coded, punch-card form. Then, as soon as a competent administrator could be spared from other work, he and the research man should concentrate on this project until completed. A year and a half to two years might be required but this investment must be made if current practices and principles are to be properly checked.

To make available the considerable administrative progress made in fire control planning practices since Hornby wrote his "Fire Control Planning in the Northern Rocky Mountain Region," agreement has been reached with the regional office that this publication should be revised and brought up to date. Unless other work interferes, Assistant Supervisor Sutliff of the Bitterroot National Forest, one of Hornby's original assistants, and Gisborne of the experiment station, author of "Hornby's Principles of Fire Control Planning,"

will commence this revision during the winter of 1942-43. From the standpoint of widespread interest in, and actual use of, fire research results such a revision of Hornby's report rates high priority.

Briefly, the fire research priorities are listed as follows:

1. Finish analysis and publication of the 5-year data available from the Altitude and Aspect study. Hayes.
2. Revise fire danger meter. Gisborne.
3. Commence exploratory work in fire economics, concurrently with a revision of the Fire Problem Analysis for Regions One, Two, Three, and Four. Gisborne.
4. Complete 30-year weather summary. Stickel.
5. Analyze and prepare report on effect of timber canopy density to conclude 11-year project. Stickel.
6. Revise Hornby's Fire Control Planning report. Gisborne.
7. Analyze 10-year fire records. Unassigned.

which have a decided advantage in transportation costs. As a result of this situation, only certain species or certain grades and products of other species can compete successfully in distant markets under present conditions. For example, white pine and ponderosa pine lumber, high-grade Douglas-fir and larch flooring, cedar poles, and Christmas trees are readily marketed. Rapid overcutting of the stands of commercially desirable species and the wasteful utilization or no cutting at all of the little-used species are the direct result of this situation.

Briefly stated, the major local objective of Forest Products Research is: to discover better harvesting and wood product uses

FOREST PRODUCTS

Field of Research

The broad over-all objective of Forest Products research is (1) to aid in making timber growing more profitable through more efficient harvesting and utilization practices, and (2) to aid in providing the public most economically with needed forest products in a form that will render the most satisfactory and efficient service.

Locally, however, certain phases of this general objective must be emphasized in order to meet the peculiar need for research results in this region. Because the region as a whole is relatively remote from the thickly populated manufacturing centers of the Middle West and East; because it is scantily populated; and because it contains no large centers of manufacture, it is of necessity an exporter of raw or partially manufactured products. These products come in direct competition with those of regions to the west and south that have a decided advantage in transportation costs. As a result of this situation, only certain species or certain grades and products of other species can compete successfully in distant markets under normal conditions. For example, white pine and ponderosa pine lumber, high-grade Douglas-fir and larch flooring, cedar poles, and Christmas trees are readily marketed. Rapid overcutting of the stands of commercially desirable species and the wasteful utilization or no cutting at all of the little-used species are the direct result of this situation.

Briefly stated, the major local objective of Forest Products Research is: to discover cutting practices and wood product uses that will permit the profitable harvesting of as many species as possible from the commercial forests, thus assuring the forest products industry a permanent and important place in the economic structure of the region.

More specifically, the objectives of station products research are:

1. To provide timber harvesting and conversion information on (a) the quantity, grade, character and value of the products produced from trees of different species and size; (b) the output and degree of utilization resulting from different methods of logging and milling and for different types of equipment and machinery used; and (c) the cost of manufacture from tree stump to shipping dock.
2. To provide information on the best methods of cutting, utilizing, sorting, grading, seasoning, fabricating, packaging and shipping the forest products that can be manufactured from the merchantable forest stands of the region.
3. To provide information on the quality and suitability for specific uses of such little-used species as western larch, Douglas-fir, Engelmann spruce, lodgepole pine, and western redcedar. This work is done in cooperation with the Forest Products Laboratory and other agencies.
4. To determine (a) the durability of treated and untreated telephone poles, fence posts, ties, and timbers cut from native species;

and (b) the efficiency of different wood preservatives and treating processes. The Forest Products Laboratory is equipped for, and is working on, the fireproofing of wood material and the preservative treatment of sawed material and fabricated products.

5. To cooperate with the Forest Products Laboratory in providing regional information on national forest products research problems, and to act as a liaison agent in the dissemination of the results of the laboratory's research program.

Item number 6 below falls logically in the field of forest economics research. Inasmuch as there is no such division at this station, this item is mentioned in connection with the Division of Forest Products. Item number 7 is being handled by this division, but logically is within the field of forest economics.

6. To study (a) the established and potential markets for forest products of this region, and (b) to study transportation as it affects distribution and ultimate markets for these products.

7. To collect and compile currently for the region detailed and accurate forest products statistics on (a) the quantities produced, (b) the cost of production, (c) the selling price both wholesale and retail, and (d) the distribution.

Status of Work

The accomplishment in the field of forest products research will be considered under the five specific objectives of the preceding section.

Availability of native woods which gives various kinds of preservative treatment. A number of projects in this field have

1. In the timber harvesting and conversion studies, the Division of Forest Products has collected, compiled, and analyzed such valuable information for the more important timber species on the yield of forest products from trees of different sizes, the output and degree of utilization resulting from different logging methods, and the volumes and grades of lumber produced from different grades of logs. These studies have been confined chiefly to white pine and ponderosa pine and for certain products of these and other species such as lumber, match plank, sawed ties, and mine stull. Very little work of this kind has been done on the little-used species of this region. Until this is done, we shall not have the basic information necessary to help in the solution of the problem of successfully marketing products from these species.

2. Concerning the uses of secondary species, definite progress has been made during the last year. A station paper was prepared and released dealing with the possibilities of wood pulp production in the northern Rocky Mountain region. Preliminary investigations were undertaken to determine the possibilities of using western larch for laminated mine guides in the Butte mines and for plywood. The value of further work of this kind is obvious if this station is to redeem its responsibility in the matter of finding market outlets for the large volume of little-used species.

3. For at least thirty years, observations have been made to determine the durability of native woods when given various kinds of preservative treatment. A number of projects in this field have

already been completed and reports issued, others are about to be completed, and further observations must be made on still others in order to realize the full value on effort already expended. As rapidly as possible, projects in this field are being terminated. During the year a station paper was published summarizing the results to date of service tests conducted in the region by the Forest Service over the past 35 years.

4. In the field of markets and transportation for forest products of the region, no systematic work is being undertaken. What is being done is primarily confined to the Division of Forest Survey in connection with survey reports. Systematic effort in this field is necessary if this station expects to make any adequate solution of the problem of marketing the little-used species of its territory.

5. Regional statistics are collected currently showing the volume produced, the cost of production, and the selling value of the forest products produced within the region. Information on forest products distribution is being gathered by the Division of Forest Products in cooperation with the United States Bureau of Census. One of the most important and immediate uses for information on the cost of manufacturing and the selling value of forest products is to furnish the Division of Timber Management in the regional office with information needed to determine stumpage value of national forest timber. For the immediate future, these data are also very valuable in connection with war production effort.

Priority of Future Work

In consideration of the fact that the most important products research of this region centers around the problem of little-used species, the projects of this division listed in order of priority are given below.

1. New uses and new types of use for the little-used species.
2. Transportation, and markets for the little-used species.
3. The current collection of statistics on volume of production, costs, values, and distribution.
4. Timber harvesting and conversion studies for the little-used species.

resource statistics, is more even than analyzing and interpreting them. The really challenging job of the Forest Survey is the placing of its results, analyses, and recommendations into the hands of people in such a way that action to improve the forest situation results. The reports of the Forest Survey should, therefore, provide a fundamental integration of the various aspects of the forest situation, which can serve as the basis for definite action. This in brief is our object; the 1961 accomplishments and future plans for the Survey are treated below under two general headings: (1) Forest statistics and (2) resource planning.

Status of Work

Forest statistics. Formerly, and to a certain extent even now, there has been a general belief in this region that the Forest Survey pine value estimates were too high. In specific instances, checks of Survey data were made, and the accuracy of these checks is

FOREST SURVEY

Field of Research

The Forest Survey is rounding out its tenth year in the northern Rocky Mountain region. These have been years of modifying our procedures to secure a fully adequate set of basic data and to obtain effective production from the organization. Looking backward, we see the emphasis shifting gradually from gathering survey basic data to the analysis and dissemination of results. The job of the Forest Survey is more than the gathering and compiling of forest resource statistics, is more even than analyzing and interpreting them. The really challenging job of the Forest Survey is the placing of its results, analyses, and recommendations into the hands of people in such a way that action to improve the forest situation results. The reports of the Forest Survey should, therefore, provide a fundamental integration of the various aspects of the forest situation, which can serve as the basis for definite action. This in brief is our object; the 1941 accomplishments and future plans for the Survey are treated below under two general headings: (1) Forest statistics and (2) resource planning.

Status of Work

Forest statistics. Formerly, and to a certain extent even now, there has been a general belief in this region that the Forest Survey pine volume estimates were too high. In specific instances, checks of Survey data were made, and the aggregate of these checks is

definitely and conclusively showing that our estimates are in general not too high. As a direct result of the Survey estimates, the timber volumes of ponderosa pine in the management plan for the Bitterroot National Forest have been increased approximately 80 million board (approximately 17 percent of the original figure), with a corresponding increase of approximately one-half million board feet in the allowable annual cut. Late in 1941 the management plan for the Kootenai National Forest was completely overhauled and an upward revision is being made in the cutting budget. Survey files are being relied on directly for basic management information for the Flathead National Forest where detailed cruise information is almost entirely lacking.

Inasmuch as our statistical data are beginning to play a direct part in the management plan calculations of individual national forests and are in demand elsewhere, we have adopted a policy primarily aimed at a prompt release of basic Survey statistical tables. This we have done through the multilithing of Forest Survey Statistical Service issues for each county in western Montana. These are released as soon as the compilation procedure for the county is completed.

Field work was completed this year for the portion of this region lying west of the Continental Divide. Financed entirely by NPA funds, field work is now under way in Cascade and Lewis and Clark Counties in Eastern Montana.

With a relatively large present NPA compiling force, the office

compilation is rapidly being completed for the area west of the Continental Divide. Very little compilation work has been done for counties in Eastern Montana. This will come later after the compilation of data for Western Montana is finished.

After almost ten years the Survey information for some counties in Northern Idaho is becoming out of date. Owing to a rapid rate of cutting in some localities, and to substantial changes in forest land ownership, this information needs revision. In view of the fact that timber management is coming to rely more heavily on Survey information, it seems highly desirable that resurveys be undertaken and that they be located in counties where first work was done.

There are indications that Survey estimates of board-foot volumes may be low in localities where a large proportion of the forest area supports pole stands or partially cut stands with a scattering of residual timber. In order to increase the precision of our resurvey work, we are giving serious thought to a resurvey procedure which will involve corrections to volumes per acre in pole stands and cutover stands based on a "stripping" procedure. A detailed plan for this work will probably be submitted later.

The demand for Forest Survey type maps has been gratifying. In order to meet this demand more effectively, it has been tentatively decided to issue a lithographed forest type map for the Inland Empire region as soon as the drafting of the current season's field work has been completed. This map will probably be on a scale of one-fifth or one-fourth inch to the mile.

Resource planning. Despite the large amount of timber data that since early times have been available in this region, and despite the aggressive leadership of some of the timber protective associations and state and federal forest services, this region has lacked an overall picture of the elements in the forest situation in their relation to each other and to the local economic structure. Because of this lack, the Survey is going farther in the field of economic analysis than would otherwise have been the case.

In Northern Idaho particularly, the local situation is extremely complex because of a large number of diverse and apparently contradictory physical and economic factors to be reconciled. In many localities in Northern Idaho, timber cutting during all but boom times is almost entirely restricted to white pine and, to a certain extent, cedar poles and ponderosa pine. The belief is widespread but not quite universal that private owners cannot afford to stay in the timber-growing business. The national forests account for less than half the commercial forest land and only 35 percent of the white pine timber volume. Yet thousands and thousands of dollars have been spent on blister rust control work on the apparently well-founded assumption that the forest industries are primarily dependent upon white pine. If the little-used species eventually come into their own on the national market, will this expenditure on blister rust control be justified? The Survey report for Northern Idaho attempted to interpret the situation in this portion of the state and to show the relation between the apparently diverse elements in the situation.

This report concluded with a series of general recommendations on which a broad approach to the problem can be based. the request of,

In Lincoln County, Montana, because of the localized nature of the problem and because a well thought-out program was already being worked out, the Survey in its report for this county made quite specific recommendations applying directly to the local problem. A similar approach will be taken in preparing the Survey report for Ravalli County.

In the report for western Montana, which will be a major project for the coming year, we hope to point the way toward specific means of improving the forest situation. In contrast with Northern Idaho, the western Montana situation seems hopeful. It has a relatively abundant supply of merchantable timber, mostly in the national forests and held by a few large owners. In view of this situation, western Montana affords an outstanding opportunity for the working out of a program to stabilize its forest industries at a relatively high level. In the report for this area, the Survey hopes to suggest quite specific measures for accomplishing this end.

In all of this Survey effort we realize that it is of no advantage for us to be too far in advance of the local thinking on these problems. Therefore, we have made it a major aim in our analysis and report-writing work to present our message in terms the layman can understand and thus tend to carry him along with us. To this end, we wrote and published locally a brief report on Northern Idaho and used simple, graphic language and pictures and charts to get our message across.

message across. In addition to the usual mailing list for Survey releases, this publication has been distributed at the request of, and with a letter from, the State Superintendent of Instruction to all public schools in Northern Idaho and to all those in Southern Idaho having an average daily attendance of 75. These have been well received, and we have had a number of requests for additional copies. The Lincoln County report has likewise been written for the purpose of telling the people of Lincoln County about their local situation. We hope also it will have a direct effect in furthering a constructive forest program for Lincoln County.

Priority of Future Work

In summary, we feel that the past year has brought definite progress in getting Survey facts, figures, and interpretations into use. Our aim in preparing our program for the coming year is to make the basic Survey data available for Western Montana as rapidly as possible, and to concentrate our effort on a comprehensive analysis of the Western Montana situation. Specific priorities for different phases of the work are:

1. Complete the compilation of statistical data for counties in Western Montana.
2. Issue these statistical data as promptly as possible in the form of Statistical Service issues.
3. Issue a county report analyzing the forest situation in Lincoln and Ravalli Counties, Montana.
4. Begin the preparation of a comprehensive, analytical report for Western Montana.
5. Issue a popularly written report for the people of Western Montana telling them of their forest situation.

6. Issue a lithographic forest type map of the Inland Empire portion of the region.

7. Begin the resurvey of certain areas in Northern Idaho.

8. Continue survey field and office work for counties in Eastern Montana as long as WPA funds and personnel are available.

(1) to develop range management practices that will maintain and improve the range, and at the same time provide profitable and optimum range livestock production on the short-grass ranges of the plains, on the summer ranges, and on the intermediate spring and fall ranges; (2) to develop artificial revegetation methods best adapted to places or otherwise depleted ranges over a wide variation of site and climatic conditions, and to find species and mixtures best adapted to each; (3) to study the economic aspects of specific range practices with special emphasis on costs and returns of stable operation in various range situations; (4) to develop and perfect methods of range investigations which, with a minimum of expenditure, will adequately accomplish the three preceding objectives.

Status of Work

To date the work of the range division has been chiefly concentrated on the problem of range management on the short-grass ranges, the preceding project, and some preliminary work on the effects of cattle grazing on high summer ranges. In addition, some work of an economic nature and on research methodology has necessarily been done on all projects.

The principal range research thus far has been a study to determine the best degree of stocking and other range management

RANGE RESEARCH

Field of Research

The regional needs for research in the field of range management are: (1) to develop range management practices that will maintain and improve the ranges, and at the same time provide profitable and optimum range livestock production on the short-grass ranges of the plains, on the summer ranges, and on the intermediate spring and fall ranges; (2) to develop artificial revegetation methods best adapted to plowed or otherwise depleted ranges over a wide variation of site and climatic conditions, and to find species and mixtures best adapted to each; (3) to study the economic aspects of specific range practices with special emphasis on costs and returns of stable operation in various range situations; (4) to develop and perfect methods of range investigations which, with a minimum of expenditure, will adequately accomplish the three preceding objectives.

Status of Work

To date the work of the range division has been chiefly concentrated on the problem of range management on the short-grass ranges, the reseeding project, and some preliminary work on the effects of cattle grazing on high summer ranges. In addition, some work of an economic nature and on research methodology has necessarily been done on all projects.

The principal range research thus far has been a study to determine the best degree of stocking and other range management

practices for typical short-grass ranges at the U. S. Range Livestock Experiment Station near Miles City, Montana. This study is carried on at the U. S. Range Livestock Experiment Station in cooperation with the Montana Agricultural Experiment Station and the U. S. Bureau of Animal Industry. The cattle phase of this experiment has been carried on since 1932. Field work on this project should be continued through the summer of 1943. The unprecedented drought, which occurred during the early years of this experiment, was followed by very favorable weather conditions. Due to a slow range recovery, at least four more years will be necessary to determine the response of range vegetation and cattle to range management practices during these weather variations. Furthermore, the period of breeding usefulness of the present experimental cows will be completed in 1943. Adequate data should then be available for analysis and the drawing of sound conclusions. At that time the need for range research can be carefully considered to decide whether further work should be done on the short-grass cattle ranges, or whether some or all of this project should be transferred to summer range studies.

Unfortunately, sheep will not be available hereafter for the sheep phase of this study. It will be necessary to continue field observations through the field season of 1943 to determine vegetal response to weather and to past management practices. The results should be available for publication by early 1944. At that time, the situation will be reviewed and the priority of future work determined.

Only a limited program of range research has been possible on summer ranges since the Vigilante Experimental Range was selected to study better management practices on the important bunchgrass ranges of western Montana.

To date no research work has been done to determine livestock management practices most suitable for use on the intermediate spring and fall ranges.

Past work on the artificial reseeding project has demonstrated that crested wheatgrass is adapted to reseeding under a wide range of conditions. This species is being widely seeded on depleted range land and probably is being used on sites where some other species might be preferable. So far only rough guides for the selection of species, mixtures, and seeding methods for given sites have been developed. We are now striving to refine these guides to permit sound recommendations for reseeding under given site and climatic conditions.

Although no systematic projects have been set up in the field of range economics, there is an economic aspect to all of the going range research projects. Just recently in connection with the reseeding project a question was raised regarding the economic desirability of reseeding cutover forest land to forage species in the Bitterroot Valley.

The question of range research methodology will certainly be with us for a long time to come. Through trial, however, we are gradually learning the limitations of certain techniques, and slow progress is being made toward improving range research methods.

A brief summary of some of the significant recent findings of range research follow: As a result of three favorable seasons, the forage density on the short-grass ranges was back in early 1941 to about two-thirds of the 1933 level on quadrats of the Miles City cattle range. This represents a substantial recovery from early 1937 when density was down to about 10 percent of the 1933 level. The improved forage density, as well as better height growth, was reflected by the heaviest calves in 1941 in eight years of this experiment. At weaning time last October, the calves averaged 407.5, 453.9, and 481.6 pounds, respectively, from heavily, moderately, and lightly grazed pastures. The total cost for all forage plus supplemental feed used by the three herds has averaged 3.8, 3.7, and 2.9 cents per pound of weaning weight produced during this 8-year period. Weaning weights have averaged 53 pounds heavier on a per cow basis for moderately grazed and 45 pounds heavier for lightly grazed than for heavily grazed pastures. Furthermore, cows on heavily grazed ranges have been substantially lighter during drought as well as during more favorable years. Thus, the total weight of beef produced was reduced and costs increased by heavy grazing. The downward trend of density during the drought years and the upward trend since 1937 at a uniform rate for all intensities indicate that weather effects have so far overshadowed the effects of heavy grazing on density during this cattle range experiment.

Over a period of years, the average gains of yearling ewes on short-grass ranges near Miles City have also been significantly less

under heavy grazing than moderate and light grazing intensities. However, during the 1941 season the gains were very uniform with an average of 34.6, 34.7, and 35.3 pounds, respectively, during a period of about 8 months on heavily, moderately, and lightly grazed pastures. An abnormal supply of succulent forage was available late last summer at a time when forage is usually quite dry for good sheep gains. This apparently explains the uniformity of sheep gains for all intensities in 1941.

When stocked at the rate of about 3-3/4 acres per cow-month the mountain summer range at the Vigilante Experimental area has shown a slow rate of improvement during recent favorable seasons. This conclusion is based on utilization surveys supplemented by careful observations and other data. On the other hand, preliminary data from plots clipped three times each year to a 1-inch level indicate that production of important grass species on this summer range declines at a rapid rate. It seems probable that under favorable conditions this range may be grazed at a slightly heavier rate than 3-3/4 acres per cow-month, but available data are inadequate to determine how closely utilization may approach the 1-inch level without serious range deterioration and poor returns to the producer.

Priority of Future Work

Of first priority for the range division is to bring the present range management project for the short-grass range type to a logical conclusion. As already indicated, 4 more years of study for the cattle experiment and 2 more years of observation and measurement of

the vegetation of sheep pastures will be needed. Full benefits of a large expenditure of time and funds cannot be realized if this work is discontinued before sound conclusions can be drawn. The response of range vegetation to management practice and to weather variations is in accordance with nature's slow processes which cannot be hastened.

An appraisal of the situation in 1943 will be necessary to determine whether certain other problems of the short-grass range should have higher priority than the problem of the mountain summer ranges of western Montana. Summer ranges are of more importance locally but the short-grass ranges are far more important in the national picture. If the United States should undertake greatly to increase

wool production at home under war conditions, the short-grass ranges probably can contribute more than summer ranges to such a program.

There is urgent need, however, for a more factual basis for better management of summer ranges. The effects of heavier grazing, and of earlier use in the spring, and of grazing certain ranges by both cattle and sheep are among the questions that should be answered without unnecessary delay.

Artificial revegetation research work in this region is only just begun. Preliminary results are being used in an aggressive program of reseeded over the state. Much detailed work is needed to answer the

many questions as to best methods, species, and mixtures for the varied range conditions, but in comparison with management problems on short-grass and summer ranges artificial revegetation ranks as

third in priority.

and ponderosa pine. These observations indicated the project COOPERATING AGENCIES and plans are now being made for a field study of control measures.

FISH AND WILDLIFE SERVICE

On July 1, Mr. Forrest S. Romero of the Fish and Wildlife Service was assigned to this station as junior biologist for the purpose of carrying on studies in the field of forest and wildlife relationships.

Field of Research

The specific field of research of the forest and wildlife relationship studies outlined for this station is as follows:

1. The study of wildlife in relation to regeneration of forest tree species.
2. The study of rodents in relation to range areas.
3. Studies of game management.

Status of Work

The accomplishments during the last six months of the calendar year 1941 are listed below.

1. Wildlife in relation to the regeneration of tree species.

Accomplishments in this field fall into two classes: (a) rodents in relation to artificial reseeding, and (b) rodents in relation to forest plantations.

- (a) In this field of effort a plan was developed to study the control of rodents on areas to be direct-seeded to white pine, ponderosa pine, and Douglas-fir. Under this plan two principal work areas were selected for the carrying out of field observations.
- (b) Under this phase of the project, observations were begun to determine rodent damage in plantations of white pine

and ponderosa pine. These observations indicated the probable destructive agent, and plans are now being made for a field study of control measures.

2. Rodents in relation to range areas.

In this field a work plan is now being prepared for the purpose of determining the effect of rodents on range vegetation.

3. Game management studies.

No work has as yet been done in this field.

Priority of Future Work

The establishment of fixed work priorities for this project is in a formative stage. As it appears now, however, the several phases of this project have the following priorities:

- 1. Rodents in relation to the direct-seeding of ponderosa pine, white pine, and Douglas-fir.**
- 2. Rodents in relation to the successful establishment of forest plantations.**
- 3. Rodents in relation to range vegetation.**

CONCLUSION

The single outstanding forest problem of this region and consequently of this station is unquestionably the problem of the little-used species which make up nearly two-thirds of the local commercial timber volume. If a profitable market for all such species, particularly those in the white pine type, existed, optimum silviculture could be practiced on all commercial forest lands; fire protection, slash disposal, and cutting practices could be simplified and made less expensive; and many points in the critical forest situation alleviated.

This problem cuts across station divisional lines. Silviculture is confronted with the problem of harvesting stands in which only a small percentage of the total volume per acre can be removed and of managing the residual stands of little-used species, both sound and defective. Where the associated species are moderately sound and vigorous a cutting system which removes only the pine and cedar poles leaves a residual stand which is productive and which contains a good volume of sawlog material for a second cut. It may be difficult to again grow a white pine stand on this site by natural regeneration, however, if only the white pine is removed by the original cut. Where the associated species are highly defective and all of the white pine is removed, a worthless residual stand is left which may keep the land from becoming again productive for many years in the future. Fire Research has the problem of justifying the expense of protecting

these cutover stands which are in general the most difficult to protect. Products Research has the task of discovering more efficient and profitable methods of utilization and new uses so that the cut of these secondary species can be increased. The field of Economics must devise means of securing lower production and transportation costs, obtaining better distribution, and new markets. The fields of Pathology and Entomology are also involved because of the susceptibility of species in mixed stands of this region to insect and disease attack.

It can be safely said that this station through its several divisions and in cooperation with outside agencies has not yet made an adequate concerted attack on this problem. To be sure, some valuable work has been done in piece-meal fashion but the real lack has been an all-out integrated effort.

The problem of the little-used species is essentially economic. With the probable exception of Engelmann spruce, we know how silviculturally to cut in all of the several commercial forest types to assure a continuous production of the most valuable species, but we cannot guarantee a profitable operation. The little-used species cannot ordinarily be marketed at a profit in large quantities. As a result this region is primarily known as a pine producer. Pine has dominated the local thinking to a point where \$5 to \$8 per acre is being spent on blister rust control work on the apparently well-founded supposition that the white pine industry is worth that much to the local economy, and that without control there can be no

permanent lumber industry. We are spending as high as \$40 per acre for cutting and sanitation practices in some national forest white pine stands to assure white pine reproduction. Such costs cannot be easily justified even on the national forests.

Certain mills in the region have had good success during pre-war times in selling a fair percentage of their mixed species lumber products on the mid-western and eastern markets. If we knew what elements in the market situation made it possible for these companies or their sales departments to dispose of their "mixed," we might find the key to marketing still larger quantities of these species. If markets at satisfactory price levels are available or can be found for considerable quantities of "mixed," the justification for costly blister rust control efforts or silvicultural practices on many sites running heavily to the little-used species is reduced.

The Senior Entomologist in charge of the Forest Insect Field Laboratory at Coeur d'Alene, Idaho, has estimated that in northern Idaho alone between 75 and 90 million board feet in white pine is lost annually to insects. Timber harvesting and conversion studies in conjunction with silvicultural and forest insect susceptibility studies are needed to determine whether or not it is feasible to make light cuts in the white pine type in an effort to utilize the volume that otherwise might be lost to insects and at the same time harvest some of the "mixed." Some of the trees which may be lost from other causes of mortality, such as disease, might also be salvaged by means of such partial cuttings. Where the pines are the

backbone of the lumber industry it is essential that every means possible be taken to salvage and utilize as much as possible of the rapidly diminishing supply.

The more common of the mixed species are heavier than pine and therefore are handicapped in the long freight haul to mid-western and eastern markets. Furthermore, freight costs on lumber of a given species are exactly the same from Seattle, Washington, to Pittsburgh, Pennsylvania, as they are from Spokane to Pittsburgh. This situation handicaps the marketing of local species in competition with west coast forest products. A systematic study of the volume of various commodities and their freight rate structure is needed to provide information on which to justify basic modifications in the over-all rate structure on forest products moving out of this region.

In this conclusion section of this annual report dedicated to a critical self-analysis of our station problems and to the suggesting of ways for increasing the effectiveness of our work, five points seem worthy of recapitulation. They are:

1. Sixty-five percent of the commercial timber volume in the Inland Empire portion of this region is in the little-used species (all but white pine and ponderosa pine). It may be said, therefore, that nearly two-thirds of the problem of certain divisions of the station is tied up with these so-called problem species. Owing to the indifferent success of the pines in reproducing themselves on pine sites, the proportion of "mixed" in the second forest crop is likely to be higher.

2. It is definitely an unsound policy for this station to continue to concentrate its work in silviculture, products, fire, and economics on only one-third of our regional problem - and on a shrinking one-third at that.

3. Two decades of occasional, relatively uncoordinated approach to the problem of little-used species by one or two station divisions has certainly not solved the problem.

4. The problem is definitely of sufficient local importance to justify trying seriously to solve it. Is it of sufficient national importance to do so?

5. If it is worth solving, a major station reorganization of effort is going to be necessary to achieve signal success.

The reorganization we suggest is contained in the following two-point program:

1. A reorganization of station effort by assigning responsibility for the problem of the little-used species to a competent project leader with authority, under the general supervision of the director, to coordinate the effort of several divisions working on the different phases of this problem.

2. The undertaking at the earliest practicable time, either through a forest economics allotment or as a much needed continuation of Forest Survey work, of fundamental economic studies: (a) of markets, transportation costs; (b) in cooperation with Silviculture and Products of harvesting and manufacturing costs and returns; and (c) of fire and other protection costs.

The accomplishment of this program will make imperative the prompt filling of the present vacancy in Forest Products in order that necessary harvesting and conversion cost studies and other studies can be carried out. It will also mean that one more man should be added to the Division of Silviculture and that an economist either be added to the staff or one should be diverted, part time at least, from the Forest Survey.

The question may be asked, "How do you propose to study the problem of transportation, or of markets, or of new uses?" Frankly we do not know - not at this stage of the game. The formulation of the plan of attack should be the first job of the specialists assigned to the cooperative project. As a matter of fact, we are not sure that even they can plan an attack that will wholly solve the problem.

Prompt action, however, should be taken in attacking this problem. The little-used species are more easily marketed now than they have been for more than a decade. If we undertake this problem vigorously and promptly, we may be able to help keep the mixed species in the market picture after the return to normal conditions four or five years hence.

HARVEST CUTTINGS - WESTERN WHITE PINEFIELD DIVISION: Forest Management ResearchWORK PROJECT: SilvicultureLINE PROJECT: Harvest Cuttings (Western White Pine Type)PURPOSE OF WORK: To develop methods of cutting through investigation of controlling factors that will result in adequate natural regeneration of desired species.

REVIEW OF PAST WORK: Much of the station's silvicultural research program since its beginning has centered around methods of cutting and natural regeneration. Various studies of cutting methods, seed supply, seed germination, initial survival, establishment, and early development have been made and reported from time to time in numerous publications and station manuscripts. The results of most of these studies have been brought together in comprehensive fashion in "Natural Regeneration in the Western White Pine Type" **PROJECT STATUS SHEETS** with the publication of this bulletin, several of these studies were closed and the way cleared for new investigations. A recent study of the economics of managing western white pine forests, begun in 1935 and the results now in manuscript form awaiting publication as a departmental bulletin, has contributed materially in providing an economic evaluation of various silvicultural practices and methods. Recent work has also included studies, covering completion, of stand development during the early and middle years. In cooperation with other agencies, a preliminary survey of rust diseases in white pine was completed in 1938 and a report of results issued as station paper number 1. A descriptive report was prepared in 1940 on blister rust control in the management of western white pine. Most recent studies have been concerned mainly with the possibilities of partial cutting in western white pine stands. Studies of light cuttings in immature stands were begun in 1937 in cooperation with Administration and the Division of Forest Products. Studies of light cuttings in mature stands to harvest defective and poor vigor trees were begun as a cooperative study in 1939 with trial cuttings on the Deception Creek Experimental Forest. These were continued during 1940 with considerable promise of success.

ACCOMPLISHMENTS DURING PAST YEAR: 1. Manuscript of "show-me" booklet for Priest River Forest nearly completed. 2. Limited cooperation given Administrative organization of Forest Service and Dr. Zarlich of University of Idaho in a study of mortality in young white pine stands. 3. Continued cooperation with blister rust

HARVEST CUTTINGS - WESTERN WHITE PINE

FIELD DIVISION: Forest Management Research

WORK PROJECT: Silviculture

LINE PROJECT: Harvest Cuttings (Western White Pine Type)

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control organization. Article published on relation of blister rust control to silvicultural practice. 4. Studies of partial cuttings in stands of white pine type continued and expanded in cooperation with Administration and Bureau of Entomology & Plant Quarantine as follows: (a) Light cuttings of defective and poor vigor trees continued in 160-year-old stands on Deception Creek Forest. Four sample plots established to study intensively the effectiveness of the cuttings. (b) An administrative partial cutting in 110-year-old stand on Rapid Lightning Creek of Kaniksu Forest was utilized to study intensively partial cuttings of two intensities. (c) Partial cutting of white pine by private operators in immature stands of the St. Joe region examined and office report prepared, pointing out danger of such cuttings in reducing growing stock.

PLANS FOR 1942: 1. Prepare paper summarizing all data on early stand development in the western white pine type. 2. Complete "show-me" booklet for Priest River Forest. 3. Continue cooperation with blister rust control organization in developing guides for determining priority of areas for control work. 4. Continue studies of partial cuttings in western white pine stands in cooperation with Administration and Bureau of Entomology & Plant Quarantine as follows: (a) Continue light cuttings on Deception Creek Forest and establish two plots to determine effectiveness of cuttings. (b) Complete establishment of three plots on Rapid Lightning Creek. (c) Prepare working plan for and carry out studies of extensive light cuttings of defective and poor vigor trees in stands 100-130 years of age in Yellow Dog and Downey Creeks of Coeur d'Alene Forest. (d) Remeasure Bear Paw light cutting in 65-year stand, and establish check plot, if possible, for this cutting. (e) If time permits, establish series of three light-cutting plots in young stands on St. Joe Forest.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: C. A. Wellner and E. E. Bentley.

STAND IMPROVEMENT - WESTERN WHITE PINE

FIELD DIVISION: Forest Management Research

WORK PROJECT: Silviculture

LINE PROJECT: Stand Improvement (Western White Pine Type)

PURPOSE OF WORK: To develop cultural measures which will improve the quality and growth of immature stands.

REVIEW OF PAST WORK: Studies of intermediate cuttings were begun in 1914 with the establishment of a series of thinning plots. Work was continued in a more or less desultory fashion until 1933 when, with establishment of the Deception Creek Experimental Forest and availability of emergency funds, a moderate program of stand improvement was undertaken. Fairly extensive work was also done by the administrative organization. In 1936 available information on stand improvement practices was assembled in a mimeographed manual, "Stand Improvement Practice in the Western White Pine Type," and accepted by Administration as standard instructions for this class of work.

In 1938, in cooperation with Region One, a rather comprehensive summary of stand improvement work done in both western white pine and ponderosa pine was made. All information available, plus additional silvicultural data obtained in the field, was systematically assembled in unit reports and a brief summary of results was prepared.

A series of extensive thinnings in replicated strips, mainly to release western redcedar, have been made in the Priest River Experimental Forest. Extensive cleaning to free white pine from larch established in replicated strips adjacent to Deception Creek Experimental Forest.

Periodic remeasurements are made on the following: 20 permanent plots in young stands of less than pole size, 39 permanent plots in pole-sized stands (one of these is a subplot latin square), 4 girdling plots, and 11 small pruning plots. Results to date indicate that thinnings and improvement cuttings in pole stands should be applied with caution at the present time. Although such cuttings usually result in accelerated growth on selected trees, this may be outweighed by damage from snow and sunscald. Benefits are often outweighed also by treatment costs. Stand improvement measures offering the most promise at the present time are cleanings to release white pine (see station research note number 4, March 1940) and pruning of young white pine.

The present need in this field is to round out the experimental program to test various stand improvement measures and to bring results to date together as a guide for post-war activities.

ACCOMPLISHMENTS DURING PAST YEAR: 1. Progress report prepared covering 15-year results of Borggreve thinning made in 1925 on Priest River Forest. Results point out danger of depleting the growing stock when thinning from above in immature western white pine stands. Results especially timely as present demand for pine is forcing operators into young stands where cutting amounts to a Borggreve thinning. 2. Continued extensive stand improvement work consisting of thinnings and improvement cuttings in pole stands on the Priest River Experimental Forest.

PLANS FOR 1942: 1. Prepare and issue station research note based on 15-year progress report of Borggreve thinnings. 2. Re-examine 11 small pruning plots.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: C. A. Wellner.

STAND IMPROVEMENT - PONDEROSA PINE

FIELD DIVISION: Forest Management Research

WORK PROJECT: Silviculture

LINE PROJECT: Stand Improvement (Ponderosa Pine Type)

PURPOSE OF WORK: To develop cultural measures which will improve the quality and growth of immature stands.

REVIEW OF PAST WORK: 1. Twelve plots to test different weights of thinning established on the Lolo National Forest during 1933 in a 50-year-old ponderosa pine stand. Fifth-year remeasurement of these plots showed that ponderosa pine responds well to thinning. Greatest response was obtained in heavily thinned plots. Results, shown by fifth-year remeasurement, summarized and issued as station research note number 3.

2. Three additional thinning plots established on the Lolo National Forest in a 30-year-old stand during 1935.

3. Extensive test of pruning ponderosa pine made on more than 300 acres in the Priest River Experimental Forest.

4. A small plot to determine the relationship between pruning and subsequent infection established on the Priest River Experimental Forest during 1940.

ACCOMPLISHMENTS DURING PAST YEAR: Progress report prepared, summarizing results of the fifth-year remeasurement of the three Lolo plots.

PLANS FOR 1942: Progress report on the fifth-year remeasurement of the three Lolo plots to be issued as a station research note.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: C. A. Wellner.

STAND STUDIES - WESTERN WHITE PINE

FIELD DIVISION: Forest Management Research

WORK PROJECT: Mensuration

LINE PROJECT: Stand Studies (Western White Pine Type)

PURPOSE OF WORK: To determine composition, growth, mortality, and yield in western white pine stands.

REVIEW OF PAST WORK: 1. Type-wide study of growth and yield in fully stocked natural stands. (Published as U. S. Department Agriculture technical bulletin 323.)

2. Establishment and period remeasurement of 34 permanent and 54 semipermanent yield plots in natural stands.

3. Increment and mortality observations of residual stand on 24 permanent plots in cutover, mature, and overmature stands. Ten-year records for nine of these plots showed a consistent loss of the residual stand in net volume amounting to 20 percent the first decade, substantiating the observation that old white pine stands have a tendency to deteriorate following a heavy partial cutting.

4. Type-wide study of increment and mortality in cut-over stands using temporary plot technique. Field work done in 1928, 1937, and completed in 1938. Compilation of data completed. Project now ready for final analysis and report writing.

ACCOMPLISHMENTS DURING PAST YEAR: Remeasurement of 6 permanent plots in cutover stands.

PLANS FOR 1942: Remeasurement of 9 permanent yield plots in natural stands and 10 permanent plots in cutover stands.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: C. A. Wellner.

STAND STUDIES - PONDEROSA PINE

FIELD DIVISION: Forest Management Research

WORK PROJECT: Mensuration

LINE PROJECT: Stand Studies (Ponderosa Pine Type)

PURPOSE OF WORK: To determine composition, growth, mortality,
and yield of stands of the ponderosa pine type.

REVIEW OF PAST WORK: A total of 186 temporary yield plots established in even-aged stand during the period 1932-34 as part of an interregional growth study. Data turned over to the Pacific Northwest Station which prepared technical bulletin no. 630, "Yield of Even-Aged Stands of Ponderosa Pine" in 1938. About 110 of temporary plots selected for remeasurement as semipermanent yield plots. Six permanent yield plots in Lolo National Forest measured periodically.

ACCOMPLISHMENTS DURING PAST YEAR: None.

PLANS FOR 1942: None.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT:

STAND STUDIES - LARCH-DOUGLAS-FIR

FIELD DIVISION: Forest Management Research

WORK PROJECT: Mensuration

LINE PROJECT: Stand Studies (Western Larch-Douglas-Fir Type)

PURPOSE OF WORK: To determine composition, growth, mortality,
and yield of stands of the western larch-Douglas-fir type.

REVIEW OF PAST WORK: 1. Measurement of increment and mortality 25-
35 years after cutting on 86 temporary plots in selectively
cut stands. Most of office compilations made and preliminary
report prepared. Final report for publication yet to be pre-
pared.

2. Four permanent yield plots established during last 25 years
in fully stocked natural stands.

3. Yield study of even-aged stands made by forest survey tak-
ing data on 150 temporary plots. Of these 42 have been selected
for remeasurement as semipermanent yield plots.

ACCOMPLISHMENTS DURING PAST YEAR: Two permanent yield plots remeas-
ured.

PLANS FOR 1942: None.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT:

PLANTING

FIELD DIVISION: Forest Management Research

WORK PROJECT: Regeneration

LINE PROJECT: Planting

PURPOSE OF WORK: To develop methods of artificial regeneration which are economically and silviculturally satisfactory.

REVIEW OF PAST WORK: Investigative work in planting and nursery practice started with the establishment of the Priest River Station in 1911 and continued intermittently until 1926. Nursery studies in seedbed densities, season of sowing, and root pruning reported in numerous publications have contributed much to the development of nursery practice. Studies in direct seeding conducted between 1915 and 1921 did not develop a successful method. Results of planting investigations contributed to the development of a successful planting technique and indicated that season of planting had no appreciable effect on survival and that transplant stock was better than seedling stock. An analysis of plantation survival records, 1910-1936, inclusive, showed that spring-planted stock survived better than fall-planted stock and that average survival 10 years after planting was only 42 percent. To determine where improvements in planting practice might be made, investigations were resumed in 1936. A 5-year study of grade and age, class of stock, carefulness in planting and handling stock, and early, middle, and late spring planting was started, with the station and the regional office cooperating, and has been continued by the planting office with occasional help and advice from the station. Since 1937 the station has concentrated its efforts on investigations of direct seeding. Results of this work are as follows: (1) Western white pine, ponderosa pine, and Douglas-fir were successfully seeded on selected sites when protected from rodents. (2) In several large-scale trials satisfactory rodent control was obtained using a poisoning method developed by the Fish & Wildlife Service. (3) Fall sowing was superior to spring sowing. (4) Cultivation of ground prior to sowing on recent burns had no effect on germination and survival. (5) Sowing in prepared spots was cheaper than broadcast sowing. (6) Seeding promises to cost considerably less than planting. (7) Western redcedar and Engelmann spruce, both small-seeded species, were successfully seeded on selected sites without rodent protection.

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ACCOMPLISHMENTS DURING PAST YEAR: The direct-seeding project received an impetus during 1941 with the assignment to the station of a Junior Biologist, Forrest S. Romero, by the Fish & Wildlife Service. The project also received a very severe setback with the loss of funds for its continuation. The station has been forced to drop the junior forester assigned to the work; future participation by the station will have to be at the expense of other projects.

No new tests were made during 1941; work consisted of observing results of established tests and bringing project completely up to date so far as analysis of data and preparation of results for publication are concerned. McKeever prepared three progress reports to be issued as station research notes and Schopmeyer prepared a manuscript summing up results of the project to date for publication as a circular. Continued observation of established tests showed the following: 1. Results prove that large-scale seeding of white pine on selected sites can be a successful, practical, and economical method of establishing reproduction. Additional cost data for this species indicate that seeding can be done for from 55 to 75 percent of planting costs. 2. On a large-scale test of ponderosa pine, poisons apparently controlled rodents but seeding was a failure because of grasshopper damage. 3. Both redcedar and Engelmann spruce, especially redcedar, are exceedingly exacting in their site requirements. Seeding of redcedar in brush may be possible only in more favorable years.

PLANS FOR 1942: Cooperate with Administration and Junior Biologist of Fish & Wildlife Service in: 1. Remeasurement of established seeding tests; 2. testing various methods of rodent control.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: C. A. Wellner,
Forrest S. Romero (Fish & Wildlife Service).

PHENOLOGY

FIELD DIVISION: Forest Management Research

WORK PROJECT: Silviculture

LINE PROJECT: Silvics (Phenology)

PURPOSE OF WORK: To determine seasonal vegetative events of principal trees and shrubs in Region One.

REVIEW OF PAST WORK: Project started in 1928 with phenological observations made by rangers on 18 national forests, at Savenac Nursery, Priest River Experimental Forest, Yellowstone and Glacier National Parks. Observations dropped on 12 forests between 1932 and 1934. At the beginning of 1937 observations were being made at only nine stations. Project terminated in 1937 because the station found it impossible to give adequate technical supervision. Although a large mass of information has been collected, its usefulness is greatly limited by lack of uniformity and thoroughness in making observations. Compilation of the data and preparation of a report summarizing useful information remains to be done.

ACCOMPLISHMENTS DURING PAST YEAR: None.

PLANS FOR 1942: None.

DATE OF COMPLETION: Project terminated except for preparation of final report.

ASSIGNMENT:

GEOGRAPHIC STRAINS

FIELD DIVISION: Forest Management Research

WORK PROJECT: Genetics

LINE PROJECT: Racial Variation (geographic strains of ponderosa pine)

PURPOSE OF WORK: To determine suitability of ponderosa pine seed from different sources for planting in northern Idaho; to ascertain heritable characteristics of growth, form, and hardiness developed through adjustment of parents to local climate.

REVIEW OF PAST WORK: Trees grown from seed of ponderosa pine collected in 21 widely separated localities in western United States were planted in plots at the Priest River Experimental Forest from 1911 to 1917. Plots studied and reported upon by Kempff in 1927. Thorough field examination and measurements made in fall of 1935 and analysis made by Weidman. Differences with respect to number of needles to the fascicle, length of needles, general appearance of foliage, and thickening of hypoderm found among progeny groups derived from different regions delimited on the basis of precipitation type. Persistence of needles found not to be hereditary. Pronounced differences found among different progenies in height growth, diameter growth, relation of two, and relative height growth by years. Best growth in height and diameter made by trees derived from localities which in climate resemble locality of planting site. As sources of seed for planting in northern Idaho, experiment indicates trees of North Pacific region unsuitable because of low frost resistance, those of Black Hills and southeastern Montana questionably suitable because of early decline in growth rate, those of Central and South Plateaus and Colorado decidedly unsuitable because of distinctly poor rate of growth. Findings to date indicate most suitable general territory in which to collect ponderosa pine seed for northern Idaho use extends from Colville locality in Washington eastward a little beyond Continental Divide and from Salmon River to Canadian boundary. Manuscript "Evidences of Racial Influence in a 25-Year Test of Ponderosa Pine" by R. H. Weidman published in the Journal of Agricultural Research, volume 59, number 12.

ACCOMPLISHMENTS DURING PAST YEAR: None.

PLANS FOR 1942: None.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT:

BEHAVIOR OF FIRES

FIELD DIVISION: Forest Management

WORK PROJECT: Fire Protection

LINE PROJECT: Behavior. Daily and Seasonal Variables.

PURPOSE OF WORK: To determine the relation between meteorological elements and inflammability of the fuels of forest fires, including the factors of inflammability and how each may best be measured. Involves (1) what to measure; (2) how to measure; (3) where to measure; (4) when to measure; and (5) how to integrate these measurements into a practical scale of inflammability and fire danger.

REVIEW OF PAST WORK: Started in 1922. Five most essential factors selected. Three new instruments invented. Integrating meter developed through five models in 10 years. Two major bulletins and several articles published describing methods.

Four seasons' work on one factor, vegetative inflammability, not conclusive. Five seasons on where to measure by Altitude and Aspect have uncovered some unsuspected and much usable information.

ACCOMPLISHMENTS DURING PAST YEAR: Field application of fire danger measurement methods studied at 41 ranger stations, 20 lookout stations, and 10 supervisors' offices revealing best consistency and accuracy of measurement yet attained in this region. Several ideas obtained for improving present practices, some immediately applicable, some requiring further research. Occurrence of an easy fire season provided long-awaited data which now permits closing study of effect of timber canopy. U. S. Department of Agriculture circular 591, "Influence of Altitude and Aspect on Daily Variations in Factors of Forest Fire Danger" by G. Lloyd Hayes published February 1941. "How the Wind Blows" by H. T. Gisborne multilithed June 1941.

PLANS FOR 1942: Reduce field work to least possible, first to complete compilation and reporting on past field work not yet analyzed; second, to reduce expenses. Revise model 5 danger meter in accordance with (1) experience of past several years, (2) Washington requirement of danger measurement on a scale of 0 to 100. Prepare report on 11 seasons of fire danger factors under full sun, half sun, and full shade, completing this study of effect of timber canopy on factors of fire danger. Revise 20-year summary of meteorological data for Priest River Experimental Forest to include the last 10 years for a total of 30 years.

DATE OF COMPLETION: Unknown.

ASSIGNMENT:

H. T. Gisborne	-	Danger Measurement
G. L. Hayes	-	Altitude and Aspect
P. W. Stickel	-	Effect of Timber Canopy

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DATE OF COMPLETION: Unknown.

ASSIGNMENT:

- H. T. Gisborne - Danger Measurement
- G. L. Hayes - Altitude and Aspect
- P. W. Stickel - Effect of Timber Canopy

PRESUPPRESSION, DETECTION, SUPPRESSION

FIELD DIVISION: Forest Management

WORK PROJECT: Fire Protection

LINE PROJECT: Control. Fire Control Planning.

PURPOSE OF WORK: To determine the principles, methods, and procedures that will furnish adequate man-power and facilities for fire control at least cost in accordance with local values at stake, occurrence of fires, and fuel types.

REVIEW OF PAST WORK: Systematic, methodical evaluation of all factors most essential to planning for adequate fire control at least possible cost was pioneered in the United States by the late Lloyd G. Hornby of this station from 1931 to 1935. Limited issue of mimeographed copies of his report was soon exhausted. Requests had to be refused from 38 individuals in 1937, 8 in 1938, 5 in 1939, 1 in 1940, and 2 in 1941. Satisfactory classification of fuels has been major factor needing research. Lyman obtained useful data in 1938-1940 on 74 fires representing three rate-of-spread types under five different classes of danger. In 51 cases the data apply also to resistance to control. These are not adequate even when supplemented by information from several thousand fire reports.

ACCOMPLISHMENTS DURING PAST YEAR: An easy fire season failed to provide any fires that could be reached in time for study. Six test fires were set and measured by Stickel, who also commenced analysis of the regional fire records for 1939 and 1940 to determine rates of spread of fire by fuel types and by class of day. Detailed work plan for rate-of-spread study practically finished.

PLANS FOR 1942: Total lack of funds for field assistants on going fires and almost total lack of help from CCC camps will prevent any field work on rate of spread, resistance to control, and fuel/type classification. Finish progress report and working plan on this phase. If Assistant Supervisor Sutliff can be detailed to work with Gisborne, prepare a revision of Hornby's Progress Report Number 1, on fire control planning, incorporating improvements developed by regional office since 1936 for publication in form to meet continuing demand.

DATE OF COMPLETION: Unknown.

ASSIGNMENT: H. T. Gisborne - Fire Control Planning
P. W. Stickel - Fuel Types.

ECONOMICS OF FIRE CONTROL

FIELD DIVISION: Forest Management

WORK PROJECT: Fire Protection

LINE PROJECT: Economics

PURPOSE OF WORK: Fire control is intended to serve all phases of forestry, the production of timber, livestock, wildlife, recreation, and water. Intensity of fire control suited to one product may be unjustifiably expensive or entirely inadequate for a different product. Control for multiple use or many products may be determined by only one product, the most damageable. Adequate control at least possible cost definitely depends upon these economic objectives, and fire may benefit one product while it damages another. Under this concept "adequate control" has never yet been defined, even though the term is frequently used in Federal and State regulations and even laws.

Practically no research work has been done in this field for the past 10 or 15 years. As many economic concepts have changed radically during this period, some exploratory work is urgently needed.

REVIEW OF PAST WORK: None at this station. Gisborne's "Analysis of the Forest Fire Problem in Regions I, II, III, and IV," dated May 30, 1941, merely stresses the need.

ACCOMPLISHMENTS DURING PAST YEAR: Priest River Fire Conference recognized the urgency of exploratory work and the desirability of establishing economics as a separate phase of the fire problem.

PLANS FOR 1942: Commence identification, description, and classification of types of economic knowledge needed by fire research. In conjunction with field work needed to rewrite the Fire Problem Analysis for Regions I to IV, Gisborne should visit Regions II, III, and IV, the first two being completely foreign to him. Local discussions of various features of the fire problem can be extended to include exploration of the economic phase.

DATE OF COMPLETION: 1960-65.

ASSIGNMENT: H. T. Gisborne under direction of Alf Z. Nelson.

LOGGING AND MILLING INVESTIGATIONSFIELD DIVISION: Forest ProductsWORK PROJECT: Timber Harvesting and Conversion InvestigationsLINE PROJECT: Logging and Milling

PURPOSE OF WORK: The work divides into three parts: (1) Combination woods-and-mill studies which provide information on the quantity, grade, and value of lumber produced by trees of different sizes and grades, the cost of producing the lumber, and the size and grade of tree which it is profitable to utilize. (2) Woods studies which provide information on logging outputs and utilization. (3) Sawmill and manufacturing-plant studies which supply information on overrun, grades of lumber produced by logs of different sizes and grades, the cost of sawing, the efficiency of various plant machinery, the waste occurring in manufacture, etc.

REVIEW OF PAST WORK: Publications now available show diameter cutting limits and other information necessary to selective logging in the (1) western white pine type, (2) ponderosa pine type, and (3) larch-Douglas-fir type. Log and tree grades have been developed locally to facilitate application of the principles deduced from the studies. Also, numerous logging output and "residual wood left after logging" studies have been made in important forest types. In the sawmill, studies conducted during the past 15 years have made available information on the average overrun of lumber over log scale for all commercial species, quantitative and qualitative waste, and the volume and value losses in fire-damaged timber, river-driven logs, and logs transported over gravity chutes.

In 1937 light cuts were made in 64-year-old white pine on the Kaniksu National Forest. A publication telling about the possibilities of partial cuts in young white pine stands was distributed in 1940. Operators became interested and as a result the Kaniksu made two small commercial sales in similar age classes. In 1939 and 1940 light cuts, taking 25 percent of the total stand, were made in 160- to 180-year age classes on the Deception Creek Experimental Forest. The trees marked for cutting were of low vigor, very defective, and otherwise deteriorating. Some of the timber cut in 1939 was studied in the sawmill to determine the grades of lumber which it yielded. No additional field work was done on this study in 1941. However, computations to be handled by the Division of Forest Products are fairly well along and will be completed.

During 1940 considerable progress was made on a study to determine the relative merits of square versus round timbers for underground use in Montana's metal mines, especially in the Butte mining district.

ACCOMPLISHMENTS DURING PAST YEAR: Completed study of square versus round mining timbers. A manuscript prepared by E. F. Rapraeger for a proposed trade journal article covers the results of this study. The information presented reveals that for many years mine operators in the Butte district have used timbers in the round whenever practicable for the sake of economy. In other words, a cubic foot of round material of suitable size could be produced more cheaply than a cubic foot of sawed material. Based on conditions as they existed in 1939-40 in Montana, the cost of round material is just about half the cost of square and to substitute sawed material would double the timber bill. At the present time round timbers are used almost exclusively in stopes and in most crosscuts and drifts. Large sawed timbers are used in shafts, at pumping stations and other permanent rooms where a better class of timbering is desired than is possible with round material. Much of this sawed material is treated with preservatives to assure greater permanency. Sawed timber is also used for mine ties, for lagging, for bricking up, and for other special purposes.

PLANS FOR 1942: No new work contemplated. Compilation of data from the utilization study made in 1939 at the sawmill of the Ohio Match Company, Huetter, Idaho, will be completed. The timber studied came from a lightly cut stand of 160- to 180-year-old white pine on the Deception Creek Experimental Forest. Continue to work on the utilization end of partial cutting studies in the western white pine type.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: Marie Bouchard - Project Work
Marie Bouchard - Office Compilation.

PROPERTIES AND USES OF MINOR SPECIES AND PRODUCTS

FIELD DIVISION: Forest Products

WORK PROJECT: Timber Harvesting and Conversion Investigations

LINE PROJECT: Properties and uses of the little-used species and the properties and uses of products other than lumber.

PURPOSE OF WORK: To provide information on the available supply, quality, and suitability for specific uses of the little-used species (western larch, Douglas-fir, Engelmann spruce, lodgepole pine, western redcedar) and the properties and uses of forest products other than lumber.

REVIEW OF PAST WORK: Departmental bulletins have been published on western larch and white fir, respectively, and a pamphlet was distributed which dealt with the utilization of Montana forests for Christmas trees. Prior to 1933 about half the work necessary for a bulletin on lodgepole pine had been done when the urgency of other work compelled temporary suspension of activity.

In 1940 tests were made of the suitability of western larch for plywood. Cooperators were the Anaconda Copper Mining Company, the Milwaukee Railroad, and the Forest Products Laboratory. A start was made on a study dealing with the possibilities of establishing pulp mills in Montana.

ACCOMPLISHMENTS DURING PAST YEAR: A very comprehensive report pertaining to the possibilities of wood-pulp production in the northern Rocky Mountain region was prepared and issued as a station paper. Since it became apparent that more tests of the suitability of Engelmann spruce for wood pulp were needed, the division sent two cords of spruce from the Flathead National Forest to the Forest Products Laboratory at Madison, Wisconsin, for testing. The Great Northern Railway Company cooperated by furnishing transportation free of charge between Montana and Minneapolis, its eastern terminal. Laboratory tests covering the physical and chemical properties of the spruce in this sample shipment have been completed and in December the pulping tests were under way.

The possibility of laminating mine guides, to be made of western larch, and using them as a substitute for solid timber was briefly investigated in cooperation with the Anaconda Copper Mining Company. The company furnished the material, which was glued in Seattle, shipped back to Missoula, and tested for strength in the University of Montana testing machine by E. F. Rapraeger and Professor J. H. Ramskill.

These strength tests proved that the glue used was unsatisfactory. The Anaconda Copper Mining Company is still interested in this proposition and may desire to have additional tests made.

PLANS FOR 1942: Prepare article on lodgepole pine for trade journal publication. Follow up work on suitability of western larch for plywood and the use of larch for laminated mine guides. Continue work on wood pulp production possibilities in the northern Rocky Mountain region. Continue to study the suitability of little-used species as a substitute for metal in defense activities.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: _____ - Project Work
C. N. Whitney - Lodgepole Pine Study.

DURABILITY OF WOOD - TREATED AND UNTREATEDFIELD DIVISION: Forest ProductsWORK PROJECT: Wood Preservation InvestigationsLINE PROJECT: Service Test Records

PURPOSE OF WORK: To provide information on: (1) The durability of treated and untreated telephone poles, fence posts, ties, and other timbers produced from timber trees native to the northern Rocky Mountain region; and (2) the comparative value of various wood preservatives and treating processes.

REVIEW OF PAST WORK: Periodic examinations of wood used in various forms have been made since 1910 on about 40 installations, which include telephone and power pole lines, fence posts, mine timbers, and ties. Many progress reports and several publications presenting the results of these studies have been prepared. Treating instructions promulgated by the division in 1926, and revised at various intervals during the past 15 years, have been applied in the treatment of telephone poles, stubs, and fence posts used in Forest Service construction and maintenance work throughout the region. A handbook containing the latest revision of these instructions was distributed in 1939.

ACCOMPLISHMENTS DURING PAST YEAR: Eleven inspections of experimental timbers of various kinds were made. Reports or tables covering all of these installations were prepared. The following formal reports and articles for publication were completed:

1. "Treating Fence Posts on the Farm." Published in The Montana Farmer, September 1941.
2. "Results to Date of Studies of the Durability of Native Woods, Treated and Untreated." Issued as a station paper, September 1941.
3. "Report on Northern Pacific Test Tracks at Plains, Thompson Falls, Missoula, and Lolo, Montana." Sent to A. J. Loom, chairman of A.W.P.A. and A.R.E.A. committees on tie service records, December 1941.

At the beginning of the year the project included 15 installations, but through the completion of a study of untreated western redcedar electrification poles, conducted in cooperation with the Chicago, Milwaukee, St. Paul & Pacific Railroad Company, that number was reduced to 14 during the year.

PLANS FOR 1942: (1) Inspect the following installations: Three railway-tie test tracks, two fence post tests, and one telephone line. Prepare tables or reports covering the results of these inspections. (2) Conduct one new treating experiment on nine native species, the object being to determine penetrations in sapwood and heartwood by open-tank methods in comparison with those obtainable by pressure treatments, using matched pieces of each wood under controlled conditions. It is expected that this test will also yield some information as to the rate of absorption of the heartwood and sapwood of different species when they are all in the same tank. The material for this experiment was collected in June 1941. (3) Prepare a trade journal article on the treatability and service life of native woods.

DATE OF COMPLETION: Irregular intervals when no longer useful.

ASSIGNMENT: C. N. Whitney.

MANUFACTURING COST STATISTICS

FIELD DIVISION: Forest Products

WORK PROJECT: Forest Products Statistics

LINE PROJECT: Manufacturing Cost Statistics - Logs and Lumber

PURPOSE OF WORK: To obtain detailed logging and lumber manufacturing costs from the larger lumber companies in western Montana, northern Idaho, and eastern Washington by personal contact. The information is confidential and is used in appraising national forest timber and in logging and milling studies.

REVIEW OF PAST WORK: Detailed lumber production costs are now available from 1916 to 1940, inclusive. This is probably the most complete series available in the United States.

ACCOMPLISHMENTS DURING PAST YEAR: Costs for 1940 were obtained as usual from 22 of the bandmills in the region. These mills have about 80 percent of the region's sawmill capacity.

PLANS FOR 1942: Obtain the costs for 1941 and continue the project.

DATE OF COMPLETION: Continuing indefinitely.

ASSIGNMENT: M. Bradner and P. Neff, Regional Logging Engineer - Field Work. Marie Bouchard - Office Compilation.

PRODUCTION STATISTICS - LUMBER AND OTHER PRODUCTS

FIELD DIVISION: Forest Products

WORK PROJECT: Forest Products Statistics

LINE PROJECT: Production Statistics

PURPOSE OF WORK: (1) To obtain statistics showing the production of lumber and other timber products in Montana, Idaho, and north-eastern Washington in cooperation with the Bureau of the Census, Department of Commerce. (2) To obtain statistics showing the production of Christmas trees in western Montana.

REVIEW OF PAST WORK: As a result of work done by this station in the past, lumber production data from 1906 to the present time have been made available to the public. Figures on the production of Christmas trees are available from 1937 to date. In 1940, a pamphlet, "Highlights of the Lumber Industry," was issued. This publication was based to a considerable extent on forest products statistics collected by the division.

ACCOMPLISHMENTS DURING PAST YEAR: The lumber census was completed on May 15, when preliminary figures were issued. A total of 589 active concerns were canvassed, including 146 firms in South Idaho. Figures on Christmas tree production were obtained as usual. The number cut in western Montana in 1940 was 2,338,350 trees compared with 1,967,350 in 1939.

PLANS FOR 1942: Continue the project.

DATE OF COMPLETION: Continuing project.

ASSIGNMENT: C. N. Whitney,
Marie Bouchard.

SELLING VALUE STATISTICS - LUMBER AND OTHER PRODUCTS

FIELD DIVISION: Forest Products

WORK PROJECT: Forest Products Statistics

LINE PROJECT: Selling Price Statistics

PURPOSE OF WORK: To collect and present in usable form lumber and timber products price statistics for eastern Washington, northern Idaho, and Montana in sufficient volume to indicate periodic trends in selling price of lumber (wholesale and retail), stumpage, logs, cedar products, and ties. These data are used in appraising the stumpage value of timber sold from Forest Service lands and for other purposes.

REVIEW OF PAST WORK: Publications now available show: (1) Stumpage prices by species for each year since 1912; (2) average annual wholesale lumber selling prices for the commercially important species of the Inland Empire for each year from 1913 to 1940; and (3) log prices since 1938. In addition, unpublished records are available which show the selling price of (1) sawlogs, 1912 to 1937; (2) cedar posts and poles, 1923 to date; (3) railway ties, 1920 to date; and (4) retail lumber, 1922 to date.

ACCOMPLISHMENTS DURING PAST YEAR: The publication showing stumpage prices was revised to include 1940 figures, and, in addition, an article pertaining to log prices was distributed. On March 31, 1941, the Western Pine Association canceled the contract under which data used by the division in compiling the quarterly and annual reports on wholesale lumber selling prices, issued since 1913, had been previously obtained. As a result, a report of the wholesale selling price of lumber of different species, grades, and sizes, and quantities sold during the first quarter of 1941, was the only one compiled. During the rest of the year, the weekly prices still received from the Pine Association were used to some extent for timber appraisal purposes. The selling price statistics of cedar products, ties, and retail sales of lumber were kept up to date.

PLANS FOR 1942: Compile wholesale selling prices of lumber contained in weekly reports by the Western Pine Association, or those obtained from other sources in collaboration with P. Neff, Regional Logging Engineer. With the possible exception of the retail lumber price compilation, which may be dropped, continue the various other compilations.

DATE OF COMPLETION: Continuing indefinitely.

ASSIGNMENT: C. N. Whitney - Stumpage and Log Prices
Marie Bouchard - All Other.

INVENTORY PHASE OF FOREST SURVEYFIELD DIVISION: Forest SurveyWORK PROJECT: Forest SurveyLINE PROJECT: 1. Inventory Phase of Forest Survey in the Northern Rocky Mountain Region.PURPOSE OF WORK: A comprehensive inventory of the forests of this region as part of the forest survey of the nation.REVIEW OF PAST WORK: Field work on this project was started in 1932 and office compilation work in 1935. Up to January 1, 1941, 29.5 million acres of forest and nonforest land had been covered by the field survey; inventory field statistics had been compiled for 21.6 million acres of forest land, 25.9 million acres of forest and nonforest land. The inventory progress by calendar years was as follows:

<u>Year</u>	<u>Field work M acres</u>	<u>Office compilation M acres</u>
1932	511	-
1933	955	-
1934	10,109	320
1935	7,478	4,479
1936 $\frac{1}{2}$	637	2,239
1937 $\frac{1}{2}$	3,430	5,439
1938 $\frac{1}{2}$	2,160	4,799
1939	1,502	4,424
1940	2,711	4,175
Total	29,493	25,875

1/ In addition, most of the check cruising and stocking correlation field and office work was done during these years.

Two-inch-to-the-mile township type maps had been prepared on 27 million acres and one-inch-to-the-mile unit type maps on 26.1 million acres. Under a W.P.A. field project $1\frac{1}{2}$ million acres of gross land area in Fergus County was mapped in 1940.

ACCOMPLISHMENTS DURING PAST YEAR: Field mapping and volume estimating was completed on 2,486,000 acres in Powell, Silver Bow, Deerlodge and Granite Counties in Montana. This completed the initial field work in the Inland Empire covering a total of 32 million acres of gross land area, 25.5 million acres of forest land. Office compilation work was completed on 3.7 million acres. Two-inch-to-the-mile township maps were drafted for 3.7 million acres and one-inch-to-the-mile unit maps were drafted for 1.6 million acres.

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After suspension from June to November, the W.P.A. project was resumed in November. During the year 5.1 million acres of forest and nonforest land in Eastern Montana was covered by field work under this project. Two-inch-to-the-mile maps were drafted for 1.8 million acres. These items supplement those above which refer entirely to the Inland Empire.

PLANS FOR 1942: Complete the office compilation work for the Inland Empire. Revise the inventory data for Benewah and possibly Kootenai Counties by field examination of areas cut over or burned since the initial field work (1932 to 1934) and make adjustments for growth, insect, and other depletion factors. Continue with sponsor contribution to W.P.A. forest inventory program for Eastern Montana.

DATE OF COMPLETION: Initial phase of the work should be completed in 1942. Revision of data is a continuing project.

ASSIGNMENT:

R. K. Winters
P. D. Kemp
W. L. Royer
O. B. Johnson
C. W. Brown
M. E. Metcalf
H. J. Pissot
J. B. LaCasse
R. L. Conn

GROWTH PHASE OF THE FOREST SURVEY

FIELD DIVISION: Forest Survey

WORK PROJECT: Forest Survey

LINE PROJECT: 2. Growth and Yield. Growth Phase of the Forest Survey in the Northern Rocky Mountain Region.

PURPOSE OF WORK: To determine the present annual board foot and cubic foot volume growth for important forest types, age classes, degrees of stocking, principal species, and other classifications, and to estimate potential annual growth.

REVIEW OF PAST WORK: Construction of larch-Douglas-fir normal yield table and a cubic foot volume table for western larch has been completed. Field studies were made to determine the stocking of average stands of the principal forest types in northeastern Washington, northern Idaho, and western Montana in relation to the stocking of normal stands of the same types. Correction factors applicable to normal yield table current growth figures to obtain growth for stands of varying degrees of understocking were worked out for the major forest types in northeastern Washington, northern Idaho, and western Montana. Completed current annual growth calculation for northeastern Washington and northern Idaho. Completed and published growth report for northern Idaho. Calculated current annual growth for Lincoln, Sanders, Mineral, and Ravalli Counties.

ACCOMPLISHMENTS DURING PAST YEAR: Calculated current annual growth by forest type, species, and ownership for Flathead and Lake Counties.

PLANS FOR 1942: Calculate current annual growth for remainder of the Inland Empire - Missoula, Powell, Lewis & Clark, Silver Bow, Deerlodge, and Granite Counties, Montana. Calculate potential growth of all western Montana counties. Calculate revised current and potential annual growth for Benewah and possibly Kootenai Counties, Idaho.

DATE OF COMPLETION: Initial growth calculations for the Inland Empire should be completed in 1942. Revision of growth estimates is a continuing project.

ASSIGNMENT: P. D. Kemp.

A STUDY OF FOREST DEPLETION FROM ALL CAUSES

FIELD DIVISION: Forest Survey

WORK PROJECT: Forest Survey

LINE PROJECT: 3. Depletion. A study of forest depletion from all causes in the Northern Rocky Mountain region.

PURPOSE OF WORK: To determine as part of the nationwide forest survey the average annual forest drain from cutting, fire, insects, and disease within the region.

REVIEW OF PAST WORK: Data on average annual cutting depletion for the period 1925-1934 or thereabouts were collected, compiled, and published for the entire region. Supplemental compilations of lumber depletion were made for the years 1935, 1936, 1937, and 1938. Data on average annual fire depletion for northern Idaho compiled and also for three counties in northeastern Washington, and for Lincoln and Sanders Counties, Montana. Determination of epidemic insect and disease depletion in northern Idaho completed. Collected post-inventory cutting and fire records for Montana counties and most of the post-inventory cutting records for northern Idaho.

ACCOMPLISHMENTS DURING PAST YEAR: Determined the average annual fire drain for the period 1931-37, inclusive, for Lincoln, Sanders, Mineral, Flathead, Ravalli, Lake, Lewis & Clark, and Missoula Counties, Montana.

PLANS FOR 1942: Determine average annual fire drain 1931-37 for Powell, Deerlodge, Silver Bow, and Granite Counties, Montana.

DATE OF COMPLETION: 1942.

ASSIGNMENT:
R. K. Winters
P. D. Kemp
S. B. Hutchison
O. B. Johnson

STUDY OF PRESENT AND FUTURE REGIONAL REQUIREMENTS
FOR FOREST PRODUCTS

FIELD DIVISION: Forest Survey

WORK PROJECT: Forest Survey

LINE PROJECT: 4. Requirements. A study of present and future regional requirements for forest products.

PURPOSE OF WORK: As part of the national forest survey to determine the current needs for forest products based on present consumption and the trends in use of such products and the underlying causes for such trends.

REVIEW OF PAST WORK: Collected basic data concerning requirements of timber products by railroads, remanufacturing industries, highway departments, public utilities, the mining industry, federal agencies, counties, states, and for farm and urban construction, including also the consumption of fuelwood and fence posts. Analysis of basic data completed and report published.

ACCOMPLISHMENTS DURING PAST YEAR: Project completed in 1940.

ECONOMIC ANALYSIS OF FOREST SURVEY DATA IN REPORT FORM

FIELD DIVISION: Forest Survey

WORK PROJECT: Forest Survey

LINE PROJECT: 5. Interpretation. An economic analysis of forest survey data in report form.

PURPOSE OF WORK: To make an economic analysis of all survey data and prepare final reports by economic units and regions.

REVIEW OF PAST WORK: Preliminary and general analysis made in the forest survey county reports released in connection with the inventory phase. Revised draft of report for northern Idaho prepared for Washington Office. Started report for Lincoln County, Montana.

ACCOMPLISHMENTS DURING PAST YEAR: Submitted Idaho report to Washington Office for final editing and printing. Completed revised report for Lincoln County, Montana, and started report for Ravalli County.

PLANS FOR 1942: Publish report for Lincoln County. Complete and publish reports for Ravalli and probably Missoula Counties. Begin preparation of western Montana state report.

DATE OF COMPLETION: Initial reports for the Inland Empire should be completed in 1943. A continuing project as needs for issuing revised figures arise.

ASSIGNMENT: R. K. Winters and Forest Survey staff.

PERIODIC ADJUSTMENTS OF BASIC STATISTICS

FIELD DIVISION: Forest Survey

WORK PROJECT: Forest Survey

LINE PROJECT: 6. Keeping Findings Current. Periodic balance of timber books. Current information on forest situation.

PURPOSE OF WORK: To maintain current records of changes in forest inventory due to fire, logging, and other depletion, and to make periodic adjustments of inventory data.

REVIEW OF PAST WORK: Adjustments of northern Idaho inventory data were made on the basis of existing records and without field examination, for growth and drain, up to January 1, 1939. Field revisions of forest type maps and timber volumes were made for portions of Sanders, Flathead, and Lake Counties, Montana, that were mapped in 1934, 1935, and 1936, to make the field data for these counties current as of January 1, 1940.

ACCOMPLISHMENTS DURING PAST YEAR: A revision of pulpwood volumes in northern Idaho and northeastern Washington (based on office adjustments) to January 1, 1941, for the Pacific Pulp & Paper Journal.

PLANS FOR 1942: A reinventory by field examination of Benewah and possibly Kootenai Counties, Idaho.

DATE OF COMPLETION: A continuing project.

ASSIGNMENT: R. K. Winters and Forest Survey staff.

MANAGEMENT SHORT-GRASS RANGES

FIELD DIVISION: Range Research

WORK PROJECT: Grazing Management

LINE PROJECT: Management Short-grass Ranges - Sheep Phase

PURPOSE OF WORK: To determine the best range utilization and management practices for sheep, welfare of the range and economics of sheep production both considered.

REVIEW OF PAST WORK: Number of yearling ewes in each of a series of pastures grazed at different intensities has been increased from 42 to 104 since 1937 to keep pace with vegetation recovering from drought. Response of sheep and vegetation to weather and grazing has been studied by observing weight gains and habits of sheep and density, composition, height, and utilization of vegetation. Average sheep gains over 5 years are significantly less at the 5 percent level under heavy grazing than under moderate grazing and at the 1 percent level, for the light grazing intensity. Recovery of vegetation from drought on sheep pastures about the same as on cattle pastures except that grama grass has declined under heavy sheep grazing and is being replaced by sand dropseed and annual weeds.

ACCOMPLISHMENTS DURING PAST YEAR: According to a survey of range conditions made in 1941, 73 percent of heavily grazed pasture J, 42 percent of moderately grazed pasture K, and 21 percent of lightly grazed pasture L has been definitely damaged. Damage consisted of reduced vegetal density, soil removal, or both on areas of concentrated grazing. Continued heavy stocking has seriously depleted grama grass range and permitted establishment of dense stands of Sporobolus cryptandrus.

Average gains per ewe for 1941 season differ less than 1 pound between lots and are not significant. Only three pastures were stocked in 1941.

PLANS FOR 1942: Study response of vegetation to weather and accumulated grazing use particularly as reflected by vigor and development and crop production. Analyze data and start preparation of a publication.

DATE OF COMPLETION: In 1943 for field work.

ASSIGNMENTS: E. J. Woolfolk, Leon C. Hurtt, Clark E. Holscher, and assistants, in cooperation with the Bureau of Animal Industry and the Montana Agricultural Experiment Station at the U. S. Range Livestock Experiment Station.

MANAGEMENT SHORT-GRASS RANGES

FIELD DIVISION: Range Research

WORK PROJECT: Grazing Management

LINE PROJECT: Management Short-grass Ranges - Cattle Phase

PURPOSE OF WORK: To determine the best range utilization and management practices for cattle, welfare of the range and economics of cattle production both considered.

REVIEW OF PAST WORK: Since 1933, eight crops of calves have been produced in heavy, moderate, and lightly grazed pastures aggregating 39,873, 48,342, and 47,035 pounds, respectively, at weaning. Calf crops have averaged 77.5, 84.4, and 81.9 percent for the 20 cows of each lot for the period with a yearly average of 249, 302, and 294 pounds of weaning weight per cow. Average costs of feed (range plus hay) equal 3.8, 2.7, and 2.9 cents per pound of calf weaned, or \$12.30, \$9.52, and \$10.44 per head of weaned calf in the heavy, moderate, and lightly grazed lots, respectively. Moderate grazing gives best returns during drought as well as in normal years.

Density of all vegetation depleted by drought prior to 1937 has increased quite uniformly through early 1941 on quadrats for all three grazing intensities. Sandberg bluegrass and annual weeds which were abundant during the dry period have declined in recent years while more valuable perennial grasses have increased. Pricklypear has increased at a very rapid rate since drought.

ACCOMPLISHMENTS DURING PAST YEAR: Calves weaned from heavy, moderate, and lightly grazed pastures in 1941 were the heaviest in 8 years, averaging 407.5, 453.9, and 461.6 pounds, respectively. Calf crops for the three lots were 95, 80, and 90 percent; the largest to date under heavy use, below average for moderate use, and largest except one for light use. The breeding period was limited to 6 weeks and six bulls were used instead of one bull for six pastures, used two years with unsatisfactory results.

Total density of vegetation continued to increase but at a reduced rate as compared to the previous year. By early 1941, charted quadrats showed a 14 percent increase over the early 1940 density level, but this was only 66 percent of the pre-drought level of 1933. Height growth was above normal in 1941 and also exceeded the 1940 level due to very favorable precipitation. Summer pastures carried the 20 cows of each lot in satisfactory condition for the full 6-month period without supplemental feed.

PLANS FOR 1942: Continue study of response of range vegetation and cattle to weather and three grazing intensities. Hasten analysis of data for all phases of project.

DATE OF COMPLETION: 1946.

ASSIGNMENT: Leon C. Hurtt, E. J. Woolfolk, and Clark E. Holscher, in cooperation with Bureau of Animal Industry and the Montana Agricultural Experiment Station at the U. S. Range Livestock Experiment Station.

RESEARCH METHODS IN RANGE PLANT ECOLOGY

FIELD DIVISION: Range Research

WORK PROJECT: Grazing Management

LINE PROJECT: Evaluate existing and devise better methods and procedures for measuring response of range vegetation to habitat factors and various treatments.

REVIEW OF PAST WORK: Changes in range vegetation that occur in many experiments cannot be satisfactorily measured or evaluated by existing methods. Efforts have been made to develop and test better methods at the U.S. Range Livestock Experiment Station, but these have been done largely as incidental to project work. The "decimeter-frame" estimate method and a "plot transector" have been developed and used. A substantial saving in time has resulted from use of the former. Other changes and improvements in methods have resulted from efforts along this line but our resources are not adequate for systematic work to improve research methods on a project basis.

ACCOMPLISHMENTS DURING PAST YEAR: No new device or method developed during the year, but various improved procedures initiated in connection with various phases of the management project.

PLANS FOR 1942: Discontinue as a separate line project but continue efforts to improve procedures as a definite but incidental part of other management project work. Because of potential savings in time and expense through better methods, the study should be renewed on a project basis at the appropriate time.

ASSIGNMENT: None.

RANGE UTILIZATION STANDARDS

FIELD DIVISION: Range Research

WORK PROJECT: Grazing Management

LINE PROJECT: Management Short-grass Ranges, Utilization Standards

PURPOSE OF WORK: To develop practicable methods and standards for measuring degree of utilization on experimental short-grass ranges.

REVIEW OF PAST WORK: Clipping of paired plots, protected and grazed, tested as a means of estimating forage utilization proved unsatisfactory. A method was developed for detailed research work involving random measurements of stubbles, estimates of percents of plants grazed, and the use of height-weight curves and tables for key forage species. Improvements have been made in pasture sampling by the grid method, in methods of plant observation and the use of height-weight curves. This method is not suited for administrative use without adaptation. Efforts to supplement key species with additional species not entirely satisfactory. Bluestem wheatgrass, blue grama, and niggerwool sedge are considered as key species. Bluestem wheatgrass promises to be best indicator of general forage use in experimental cattle pastures. Utilization classes developed to apply to chart and density list quadrats. Some correlation between stubble heights and calf gains is in evidence.

ACCOMPLISHMENTS DURING PAST YEAR: Utilization surveys were repeated on the summer and winter cattle pastures and on the sheep pastures near the end of the various grazing periods. After analyses of previous data, the sampling intensity on the summer cattle pastures was reduced and field and office procedures shortened and simplified by broadening the subtype classification. Plants of bluestem wheatgrass and blue grama collected and segmented for additional height-weight data to test for differences due to sites, height of plants, years, and grazing intensities. Data not yet analyzed.

PLANS FOR 1942: Continue the utilization work on the cattle pastures as a part of the short-grass range management project with emphasis on (1) speeding up and simplifying the method now in use, (2) furthering study on height-weight relationships as influenced by years, site, height of plants, and grazing treatment, (3) striving to test correlation of utilization with calf gains and weights, and (4) attempting to base utilization standards on amount of forage remaining rather than amount removed.

DATE OF COMPLETION: This work has largely passed the developmental stage. The surveys will be made yearly as heretofore and better procedures will be adopted from time to time. Hereafter this work will be considered as a part of the sheep and cattle management phases rather than carried as a separate line project.

ASSIGNMENT: Combined with sheep and cattle phases of short-grass range management project.

MANAGEMENT SUMMER RANGES

FIELD DIVISION: Range Research

WORK PROJECT: Grazing Management

LINE PROJECT: Management Summer Ranges

PURPOSE OF WORK: To determine best management and utilization practices for summer cattle and sheep ranges, vegetation and economics of livestock production both considered.

REVIEW OF PAST WORK: Research for summer ranges on a limited basis due to restricted funds. Studies have been initiated to develop guides to grazing capacity and season of use for cattle range. Since 1938 an annual utilization survey has been conducted, based on measurements of about 4,500 plants for certain key species, grazed and ungrazed, and use of R-1 Forage Volume Tables. The weight of forage produced by key species as affected by clipping at various heights and intervals of time has been investigated since 1938.

In 1938 a plant development study was established at four elevations on grazed and ungrazed ranges. Preliminary data indicate that grazing season may open before June 1 in some years. Quadrats were established in 1939 to study density changes on grazed and ungrazed sites at two different opening dates, but trends not clearly defined in 1940.

ACCOMPLISHMENTS DURING PAST YEAR: Plots that were clipped three times during each of three successive years produced less grass the second and third than the first year, but the yield of those clipped only once had not changed materially through the three years. Clipping data for 1941 not yet analyzed. Plant development data for the years 1938, 1939, and 1940 show that 90 percent or more of the culm-producing Festuca and Poa plants up to about 7,000 feet elevation had reached the boot stage by May 25 or about a week earlier than the June 1 opening date. The utilization survey method was further simplified by limiting measurements to two key species instead of three.

PLANS FOR 1942: Continue clipping, density, and plant development studies. Improve the technique for measuring range utilization.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Leon C. Hurtt and Grant Harris or Paul Lemon.

January 1942

METHODS OF ARTIFICIAL REVEGETATION

FIELD DIVISION: Range Research

WORK PROJECT: Artificial Revegetation

LINE PROJECT: Methods

PURPOSE OF WORK: Develop low cost methods for the artificial revegetation of depleted or formerly plowed range lands.

REVIEW OF PAST WORK: Plantings were made on more than 2,000 acres of abandoned croplands and depleted range lands since 1933 in 24 Montana counties and on 10 national forests, resulting in development of guides for species to reseed, season and depth for planting, and sowing methods. Manuscript prepared for Farmers' Bulletin on "Re seeding to Improve Montana Range Lands." Advice and guidance furnished CCC crews on national forest re seeding of logged, logged and burned, and severely overgrazed and depleted areas. Experiment established testing results of seedbed preparation on establishment of seeded species. Project analysis and work plans begun.

ACCOMPLISHMENTS DURING PAST YEAR: Manuscript for Farmers' Bulletin on re seeding revised and submitted for publication. Seedbed preparation tests showed better grass stands established on prepared soil where some weed competition removed than on unprepared soil with full weed competition. Tests for cheap method of re seeding in dense downy brome stands begun in the Bitterroot Valley. Tests for best method of planting blue grama started at Miles City. Preliminary results from CCC national forest plantings showed practicability of broadcast seedings on logged or burned areas and overgrazed, depleted mountain parks.

PLANS FOR 1942: Complete project analysis and work plans. Continue going experiments and records on plantings including tests for best methods of planting blue grama and for re seeding in dense downy brome types. Stress methods applicable to abandoned cropland.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Leon C. Hurtt, Gordon D. Merrick, and W. Luther Norem.

SITE FACTORS IN ARTIFICIAL REVEGETATION

FIELD DIVISION: Range Research

WORK PROJECT: Artificial Revegetation

LINE PROJECT: Site Factors

PURPOSE OF WORK: Determine effect of edaphic, biotic, climatic, physiographic, or other site factors on artificial revegetation.

REVIEW OF PAST WORK: Guides set up for density of native vegetation which marks competition too great for successful reseeding to crested wheatgrass. This species is adapted to many sites from 2,300 to 8,600 feet elevation. Partial shade reduced soil temperatures and proved to be important factor in seedling survival. Weed competition found to reduce seedling survival more in spring than in fall plantings. In dense, native bunchgrasses, reseeding success was directly proportional to the amount of competition destroyed by soil cultivation. Several species were planted on land abandoned 1 to 5 years to test survival in plant associations present. Site selected at 9,300 feet elevation for testing effects of high altitude.

ACCOMPLISHMENTS DURING PAST YEAR: Establishment reseeded species found good on land abandoned from cultivation one year with Russian thistle type, uncertain on land abandoned three years with dense weeds, sweetclover, and Japanese chess, poor in very dense Japanese chess on land abandoned five years. Five promising species, Agropyron cristatum, A. inerme, and A. intermedium, Bromus erectus, and Elymus junceus, planted in replicated tests of three soil types at Miles City. In the Bitterroot Valley, a study of effects of competition of dense downy brome on establishment of seedlings begun.

PLANS FOR 1942: Continue studies of effects of competition on establishment of seedlings on logged and burned land on Bitterroot and on abandoned croplands. Plant high altitude test nursery. Delimit zones of similar site conditions from existing records.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Leon C. Hurtt, Gordon D. Merrick, and W. Luther Norem.

January 1942

SPECIES AND MIXTURES FOR ARTIFICIAL RANGE REVEGETATION

FIELD DIVISION: Range Research

WORK PROJECT: Artificial Revegetation

LINE PROJECT: Species Adaptability

PURPOSE OF WORK: Test adaptability of certain species and mixtures for revegetation and test grazing value of promising ones.

REVIEW OF PAST WORK: Wide adaptability of crested wheatgrass and more limited or low reseeding value of others shown by plantings made past 8 years. Adaptation nurseries were established near Miles City, Missoula, Vigilante, and Thompson Falls, with 36 to 107 accessions planted at each. Species appearing promising from nursery trials selected and planted on range adaptation areas, 18 species and 5 mixtures near Lewistown, 13 species and 5 mixtures near Miles City. A third range adaptation area has been selected near Stevensville. Comparative grazing value tests of crested wheatgrass and native range were begun at Miles City. Ten species were planted in 1940 on overgrazed range and 5 species were broadcast on a steep eroding hillside at 7,600 feet elevation on the Beaverhead N.F. Logged and burned Bitterroot N.F. areas reseeded in 1940 by cheap methods with 8 species in spring plantings and 10 species in fall plantings gave substantial stand of most species on heavily burned spots but not where competition was severe.

ACCOMPLISHMENTS DURING PAST YEAR: Bitterroot range adaptation area near Stevensville planted with 20 species and 5 mixtures. Additional species and strains planted in nurseries. Uniform grass nursery tests begun on four species at Miles City and one species at Vigilante. Observations made on range adaptation areas showing several species probably suited for more extensive plantings. Bitterroot forest range plantings showed five especially promising species. Three other species are fairly promising.

Yearling steers and heifers on crested wheatgrass pasture gained an average of 2.01 pounds per day from May 1 to August 7 as compared to 1.93 pounds per day on nearby native range. The grass was not grazed during its dormant period after August 7. Fall growth was succulent and watery and weight gains averaged only 0.7 pound per day for 28 days of September and October.

PLANS FOR 1942: Establish additional range adaptation areas for testing of promising species. Plant best species from nurseries in range adaptation areas. Plant high altitude nursery at Vigilante.

DATE OF COMPLETION: Indefinite.

ASSIGNMENT: Leon C. Hurtt, Gordon D. Merrick, and W. Luther Norem.

January 1942

PUBLICATIONS

I. PUBLISHED DURING 1941

A. Departmental Bulletins and Circulars

Haig, I. T., Davis, E. P., and Widman, H. H.

1. Natural regeneration in the western white pine type. Technical Bulletin no. 757. Gov't. Printing Office, Washington. May 1941.

Hayes, G. Lloyd.

2. Influence of altitude and aspect on daily variations in factors of forest-fire danger. Circular no. 501. Gov't. Printing Office, Washington. February 1941.

B. Outside Publications

Braden, H.

3. Modern forest management for utilization. (Discussion on Emanuel Fritts' paper of above title.) Mechanical Engineering 64(5):394-395. May 1941.

APPENDIX

Glenn, E. T.

4. The new trend in forest control. Michigan Forester (and Arbor), pp. 12-13, 1941.

Hart, L. G.

5. Restocking for northern forest plains. The Montana Stockgrower, vol. 12, no. 5, p. 5. August 1941.

Kapreger, E. F.

6. Did you know that..... Intermountain Logger (Third Intermountain Logging Conference), April 1941.

Kapreger, E. F.

7. Frontier journal. The Tyghman, vol. XLII, no. 7, May 1941.

Kapreger, E. F.

8. Christmas tree industry in Montana. The Tyghman, vol. XLII, no. 2, December 1941.

Willner, G. A.

9. Blister rust control in relation to white pine silviculture. Idaho Forester (Moscow), vol. 23, pp. 12-13. 1941.

January 1942

PUBLICATIONS

I. PUBLISHED DURING 1941

A. Departmental Bulletins and Circulars

Haig, I. T., Davis, E. P. and Weidman, R. H.
Natural regeneration in the western white pine type.
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Influence of altitude and aspect on daily variations
in factors of forest-fire danger. Circular no. 591.
Gov't. Printing Office, Washington. February 1941.

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Redwood forest management for utilization. (Discussion
on Emanuel Frits' paper of above title.) Mechanical
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(Ann Arbor). pp. 16-18, 57. 1941.

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Restocking for northern Great Plains. The Montana
Stockgrower, vol. 12, no. 9, p. 8. August 1941.

Rapraeger, E. F.
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Intermountain Logging Conference), April 1941.

Rapraeger, E. F.
Frontier sawmill. The Timberman, vol. XLII, no. 7,
May 1941.

Rapraeger, E. F.
Christmas tree industry in Montana. The Timberman,
vol. XLIII, no. 2, December 1941.

Wellner, C. A.
Blister rust control in relation to white pine silvi-
culture. Idaho Forester (Moscow), vol. 23, pp. 13-15.
1941.

Whitney, C. N.

Treating fence posts on the farm. *The Montana Farmer*,
vol. 29, no. 1, September 15, 1941. *Prod.*

Winters, R. K.

The American Forest Survey. University of Washington
Forest Club quarterly, 14(2):14-20. 1941. *Survey*

G. Multilithed and Mimeographed Progress Reports *Prod.*

Division of Forest Products

Wholesale lumber prices, fourth quarter, 1940.
(Confidential - not for distribution.) Mimeog.
January 1941.

Division of Forest Products

Wholesale lumber prices, first quarter, 1941.
(Confidential - not for distribution.) Mimeog.
May 1941.

Division of Forest Products

Monthly summary of business conditions in the lumber
industry. Issued monthly, January-August 1941. Mimeog.

Division of Forest Products

Cedar products prices as of December 1, 1940.
(Confidential - not for distribution.) Mimeog.
January 1941.

Division of Forest Products

Lumber selling values since 1913. (Confidential - not
for distribution.) Revised February 1941 to include
1940 figures. Mult.

Division of Forest Products

Stumpage transactions in the northern Rocky Mountain
region in 1940. Mimeog. March 25, 1941.

Division of Forest Products

Review of cross-tie specifications as of April 15,
1941. Mimeog. April 1941.

Division of Forest Products

Amendments to review of cross-tie specifications
issued April 15, 1941. Mimeog. October 15 and
December 30, 1941.

Division of Forest Products

Lumber production by years in the northern Rocky Mountain
region. Revised May 1941 to include 1940 figures. Mult.

Division of Forest Products

Preliminary 1940 log prices in the northern Rocky Mountain region. Research note no. 15. Mimeog. & mult. May 24, 1941.

Products

Division of Forest Products

Cost of manufacturing lumber, exclusive of interest and discount, for Inland Empire sawmills during 1940. (Confidential - not for distribution.) Mult. July 1941.

Division of Forest Products

Directory of wood-preserving plants and secondary wood-using industries in the northern Rocky Mountain region. Mimeog. August 1941.

Division of Forest Products

Determining tree d.b.h. from stump measurements. Research note no. 16. Mimeog. & mult. September 5, 1941.

Gisborne, H. T.

Character of the 1940 fire season in Region One. Research note no. 3. Mimeog. February 1941.

Fire

Gisborne, H. T.

How the wind blows in the forest of northern Idaho. Progress report. Mimeog. 1941.

Noran, W. L.

Forest and range research in the northern Rocky Mountain region. Written as a section for the Region One clerks handbook. To be mimeographed.

Range

Rapraeger, E. F.

Christmas tree production in western Montana in 1940. Research note no. 12. Mimeog. January 10, 1941.

Prod

Rapraeger, E. F.

Possibilities of wood-pulp production in the northern Rocky Mountain region. Station paper no. 4. Mimeog. March 1941.

Rapraeger, E. F.

Characteristics of some important commercial woods which are native to the northern Rocky Mountain region. Mult. May 1941.

Wellner, G. A. and Ralph Hansen

Volume distribution in ponderosa pine trees. Research note no. 17. Mult. November 1941.

Silv

Prod

Whitney, C. N.

Production of lumber, lath, and shingles in Idaho and Montana, 1940. Research note no. 14. Mimeo. May 15, 1941.

Whitney, C. N.

Results to date of studies of the durability of native woods, treated and untreated. With an introduction by E. F. Rappenger. Station paper no. 5. Mimeo. September 1941. Revised and resubmitted January 1942.

Whitney, C. N. Blair and R. E. Gist

The forest situation in northern Idaho. U. S. Department of Agriculture miscellaneous publication, 50-55 pages, illustrated, 25 charts, 16 pictures. Being edited.

Short, L. R.

Proceeding to improve Montana range lands. U. S. Department of Agriculture farmers Bulletin, 16 pages, illustrated, 13 pictures. Revised and resubmitted October 1941.

B- Forest manuscripts to be submitted for consideration during fiscal year 1942

Rappenger, E. F.

How to scale logs in cubic feet. U. S. Department of Agriculture circular, 16 pages, illustrated. (Original manuscript submitted September 1941, to be revised.)

Schuyler, C. A.

Seedling as a means of reforestation in the northern Rocky Mountain region. U. S. Department of Agriculture circular, 20-25 pages, illustrated, 2 pictures, 4 graphs. Prepared in September 1941.

Stichel, Paul W.

Effect of timber canopy on fire weather and fire danger in the white pine type. U. S. Department of Agriculture circular, 20-25 pages, illustrated, 3 pictures, 3-10 graphs.

II. ESTIMATE OF DEPARTMENTAL PRINTING NEEDS FOR OUTSIDE

A. Formal Manuscripts to be Submitted for Departmental Publication Prior to June 30, 1943

Hurtt, L. C.

Management of northern Great Plains ranges to minimize the effects of drought. U. S. Department Agriculture technical bulletin, 40-50 pages, illustrated, 14 pictures, 7 charts. Revised and resubmitted January 1942.

Rutheison, S. Blair and R. K. Winters

The forest situation in northern Idaho. U. S. Department Agriculture miscellaneous publication, 50-60 pages, illustrated, 35 charts, 16 pictures. Being edited.

Short, L. R.

Receding to improve Montana range lands. U. S. Department Agriculture farmers bulletin, 16 pages, illustrated, 15 pictures. Revised and resubmitted October 1941.

B. Formal Manuscripts to be Submitted for Departmental Publication During Fiscal Year 1943

Rapraeger, E. F.

How to scale logs in cubic feet. U. S. Department of Agriculture circular, 16 pages, illustrated. (Original manuscript submitted September 1941, to be revised.)

Schepmeyer, C. S.

Seeding as a means of reforestation in the northern Rocky Mountain region. U. S. Department of Agriculture circular, 20-30 pages, illustrated, 2 pictures, 4 graphs. Prepared in September 1941.

Stickel, Paul W.

Effect of timber canopy on fire weather and fire danger in the white pine type. U. S. Department of Agriculture circular, 50-60 pages, illustrated, 5 pictures, 8-10 graphs.

Winters, R. K.

The dollars and cents value of the forest to northern Idaho. The Idaho Forester.

III. ARTICLES AND OTHER MANUSCRIPTS PROPOSED FOR OUTSIDE PUBLICATION DURING CALENDAR YEAR 1942

Gisborne, H. T. Tracks at Plains, Thompson Falls, Missoula, and Lolo, Montana. For American Wood Preservers' Association.
Chance and whither forestry? Journal of Forestry.

Gisborne, H. T.
Model 3 fire danger meter for the northern Rocky Mountain region. Journal of Forestry.

Gisborne, H. T.
Milestones of progress in fire control. To be published in Fire Control Notes and Journal of Forestry. (To be edited by A. A. Brown.) Written 1941.

Hayes, G. Lloyd
Where and when to measure fire danger. Washington Office Fire Control Notes. Approximately 4-5 pages.

Hayes, G. Lloyd
Method of measuring rainfall on windy slopes. Monthly Weather Review.

Hayes, G. Lloyd
Differences in fire danger with altitude, aspect, and time of day. Journal of Forestry. Accepted but not yet published.

Hurt, L. G., R. W. Collins and G. E. Holscher
A method for measuring utilization of bluestem wheatgrass. For Journal of Forestry.

Norem, W. L.
Major change in herbaceous vegetation on the ranges of eastern Montana from 1923 to 1941. For Ecology.

Rapraeger, E. F.
How wood is used in Montana's metal mines. For The Timberman. Prepared in September 1941.

Wellner, G. A.
A simple method for estimating light intensity beneath forest canopies. For Journal of Forestry.

Winters, R. K.
The dollars and cents value of the forest to northern Idaho. The Idaho Forester.

DIRECTORY OF PERSONNEL

NORTH WHITNEY, C. N. MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Report on Northern Pacific test tracks at Plains,
Thompson Falls, Missoula, and Lolo, Montana. For
Proceedings of American Wood Preservers' Association.
Submitted to A.W.P.A. Committee 7-1 in December 1941.

OVERHEAD ADMINISTRATION

Whitney, C. N. Director
Melvin Treatability and service life of native woods. For
Mary J. The Timberman. Jr. Administrative Asst.
Dagmar Nelson Senior Stenographer
H. Whitney, C. N. Asst. Clerk-Stenographer

FIELD STATION The suitability of lodgepole pine for telephone and power line poles. For the Electrical World.

Deception Creek Experimental Forest Elton E. Bentley
Priest River Experimental Forest John D. Crowe
Miles City Experimental Range E. Joseph Woolfolk
Vigilante Experimental Range Grant A. Harris

DIVISION OF SILVICULTURE

Charles A. Wellner
Elton E. Bentley
Donald G. McKeever

Management

80%

Regeneration

Asst. Silviculturist 15%
Head Forest Guard
Junior Forester 100%

DIVISION OF FOREST PROTECTION

Harry T. Gisborne
Paul W. Stickel
G. Lloyd Hayes
John D. Crowe

Senior Silviculturist
Silviculturist
Assistant Forester
Jr. Agricultural Aid

DIVISION OF RANGE RESEARCH

Leon C. Hartt
Gordon D. Herrick
E. Joseph Woolfolk
Clark E. Holscher
Grant A. Harris
Paul C. Lemon
W. Luther Norem
Lester A. Keilman
Anthony B. Evanko
Henrietta A. Pissot

Graz. Manage. Apt. Ranged.

80% 25%
100% 100%
100%
100%
90% 10%
50% 50%
100%
20% 20%
75% 25%

Senior Range Examiner
Assoc. Forest Ecologist
Assoc. Forest Ecologist
Asst. Range Examiner
Junior Range Examiner
Junior Range Examiner
Jr. Plant Physiologist
Asst. Agricultural Aid
Asst. Agricultural Aid
Jr. Clerk-Stenographer

DIVISION OF FOREST PRODUCTS

Chester E. Whitney
Marie E. Bouchard

Forest Statistics

25%
20%

Wood Pres.

Associate Forester 60%
Assistant Clerk 5%

DIRECTORY OF PERSONNEL

NORTHERN ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

January 5, 1942

OVERHEAD ADMINISTRATION

Melvin I. Bradner
Mary J. Pershina ✓
Dagmar Nelson
Helen B. Davis ✓

Director
Jr. Administrative Asst.
Senior Stenographer
Asst. Clerk-Stenographer

FIELD STATIONS

Deception Creek Experimental Forest
Priest River Experimental Forest
Miles City Experimental Range
Vigilante Experimental Range

Elton E. Bentley
John D. Crowe
E. Joseph Woolfolk
Grant A. Harris

DIVISION OF SILVICULTURE

lv. Inv.
65%
100%
-

Charles A. Wellner ✓
Elton E. Bentley ✓
Donald G. McKeever ✓

Mensuration

20%
-
-

Regeneration

Asst. Silviculturist 15%
Head Forest Guard -
Junior Forester 100%

DIVISION OF FOREST PROTECTION

Harry T. Gisborne
Paul W. Stickel
G. Lloyd Hayes ✓
John D. Crowe

Senior Silviculturist
Silviculturist
Assistant Forester
Jr. Agricultural Aid

DIVISION OF RANGE RESEARCH

Graz. Manage. Art. Reseed.

Leon C. Hurtt 80% 20%
✓ Gordon D. Merrick - 100%
E. Joseph Woolfolk 100% -
Clark E. Holscher 100% -
Grant A. Harris 100% -
✓ Paul C. Lemon 90% 10%
✓ W. Luther Norem 50% 50%
✓ Lester A. Keilman 100% -
Anthony B. Evanko 80% 20%
Henrietta A. Pissot 75% 25%

Senior Range Examiner
Assoc. Forest Ecologist
Assoc. Forest Ecologist
Asst. Range Examiner
Junior Range Examiner
Junior Range Examiner
Jr. Plant Physiologist
Asst. Agricultural Aid
Asst. Agricultural Aid
Jr. Clerk-Stenographer

DIVISION OF FOREST PRODUCTS

Harv. & Conv.

-
15%

Chester N. Whitney
✓ Marie E. Bouchard

Forest Statistics

40%
80%

Wood Pres.

Associate Forester 60%
Assistant Clerk 5%

DIVISION OF FOREST SURVEY

✓ Robert K. Winters
Paul D. Kemp
✓ S. Blair Hutchison
William L. Royer
✓ Orlo B. Johnson
✓ Clarence W. Brown
✓ Melvin E. Metcalf
✓ Robert L. Conn
John B. LaCasse
✓ Eric G. Rutquist
✓ W. Howard Welton
✓ Henry J. Pissot
Catherine M. Mead
Helen I. Forney

Senior Forester
Assoc. Forest Economist
Asst. Forest Economist
Assistant Forester
Agricultural Aid
Asst. Agricultural Aid
Asst. Agricultural Aid
Jr. Agricultural Aid
Statistical Draftsman
Jr. Engineering Draft
Jr. Engineering Draft
Asst. Statistical Clerk
Jr. Clerk-Stenographer
Jr. Calculating Machine
Operator

FOREST BIOLOGY (in Cooperation with Fish & Wildlife Service)

Forrest S. Romero

Jr. Biologist

DISTRIBUTION OF DIRECT COSTS BY MAJOR PROJECTS

F. Y. 1942

Financial	Salaries	Travel	Supplies	Other	Regular	Tempo	Total
<u>DIRECT AND INDIRECT COSTS BY FINANCIAL PROJECTS</u>							
	Salaries	Travel	Supplies	Other	Regular	Tempo	Total
	Costs	Costs	Costs	Costs	Costs	Costs	Costs
	(Overhead)	(Overhead)	(Overhead)	(Overhead)	(Overhead)	(Overhead)	(Overhead)

F. Y. 1942

FOREST MANAGEMENT

Financial Project	Indirect Project Costs (Overhead)	Direct Project Costs	Total Costs
Reforestation Inv.		570 433 975	1575
Forest Management	\$ 3,195	\$ 22,555	\$ 25,750
Regeneration Inv.		35 217 252	242
Range Investigations	4,370	28,730	33,100
Fire Protection Inv.	842 842	432 12375 12807	13247
Forest Products	1,910	10,190	12,100
Total	625 1338	1470 12375 13845	14183
Forest Survey	4,625	30,375	35,000

RANGE INVESTIGATIONS

Total	14,100	91,850	105,950
Grazing Management Inv.	432 432	201 10300 10732	11200
Artificial Revegetation	155 210 470	2332 52 2384	2384
Total	770 445	1271 23632 24903	25674

FOREST PRODUCTS

Timber Harvesting and Conversion	5 124 230	2003 435 2438	2438
Forest Products Statistics	5 241 170	2125 575 2700	2700
Wood Preservation Inv.	42 140	1812 135 1947	1947
Total	10 475 640	7930 1225 9155	9155

FOREST SURVEY

Survey of Forest Resources, etc.	400 750 5750	52700 2715 58375	58375
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Grand Total	1003 5718 7151	69634 10024 80209	80209
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DISTRIBUTION OF DIRECT COSTS BY MAIN PROJECTS

F. Y. 1942

Financial and Work Project	Cars, maintenance, & new	Scientific equipment, ment, etc.	Travel expenses: other than cars	Salaries Regular; Temporary	Total
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FOREST MANAGEMENT

Silvicultural Inv.	560	500	525	2150	2725	6290
Mensuration Inv.			270	433	570	1273
Regeneration Inv.			25	217		242
Fire Protection Inv.	<u>245</u>	<u>868</u>	<u>690</u>	<u>12575</u>	<u>422</u>	<u>14760</u>
Total	625	1368	1470	15375	3717	22555

RANGE INVESTIGATIONS

Grazing Management Inv.	635	335	801	15300	2505	19576
Artificial Revegetation	<u>135</u>	<u>110</u>	<u>470</u>	<u>8389</u>	<u>50</u>	<u>9154</u>
Total	770	445	1271	23689	2555	28730

FOREST PRODUCTS

Timber Harvesting and Conversion	5	194	330	3905	405	4839
Forest Products Statistics	5	241	170	2129	675	3220
Wood Preservation Inv.	<u>—</u>	<u>40</u>	<u>140</u>	<u>1216</u>	<u>135</u>	<u>2131</u>
Total	10	475	640	7850	1215	10190

FOREST SURVEY

Survey of Forest Resources, etc.	400	730	3750	22760	2715	30375
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Grand Total	1805	3018	7131	69694	10202	91850
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